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market report**

Optical Storage Technology

Pharmaceutical Companies

Universities/Colleges

Hospitals

Non-hospital Markets

Public Organizations

Professional Associations

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Commercial Ventures

Worldwide

Testing & Certification

Health Promotion

Marketing/Promotion

CD-ROM

Information Systems

Videodisc Effectiveness Research

Resources

Videodiscs In Healthcare

A Guide to the Industry

Edited by

Scott Alan Stewart

Editor and Publisher

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Glossary

Appendix

Chapter 1

Optical Storage Technology

It's easy to be confused by the different forms of optical storage technology—digital optical disc, videodisc, CD-ROM, CD-I, DVI, laser card, etc. All of these formats use a light source (laser) to record and read information. In general, videodiscs are the best method of storing motion sequences from videotape or film and for storing large picture or slide collections. Digital optical disc, CD-ROM and the LaserCard are best used to store large databases and other records, along with computer graphics and some digitized images. In the future, when digital video formats such as CD-I or DVI are fully developed, these new formats will be able to combine audio, video, text, and graphics in ways never available before.

Analog Vs Digital Storage

To help make the distinction between analog and digital, think of different clocks you have seen. The old style clock, with a minute hand, an hour hand, and a sweeping second hand, is an analog clock. It has a continuous range of motion as it moves around the dial. The newer digital clocks, however, always display an exact time. They move by finite increments, be it minutes, seconds, or portions of a second.

Likewise, information can be stored as a continuous range of value or in binary form—on or off, ones or zeros. Videodiscs currently are the best optical medium for the storage of analog material such as videotapes, films, photographs, and slides. Although it is possible to digitize analog information and store it on optical discs, digitized images take up a great deal of memory, thereby drastically reducing the amount of material that can be stored on a single disc.

As mentioned above, digital information is expressed as a binary code. Computers work with data that is stored, in magnetic or optical form, as digital information. Large databases and medical records which have been entered into a computer can then be stored on a digital optical disc or CD-ROM. Sound can also be digitized and stored on optical disc, as seen in the music industry with compact discs (CDs).

Comparing The Two.

In order to understand the difference between analog storage and digital storage, let's look at the difference in the way videodisc and CD-ROM store the same information. As an example, let's say we wanted to record the pictures and text found in an encyclope-

dia. Both videodisc and CD-ROM formats would be able to record the entire set on a single disc. However, the videodisc would have to record an actual photograph of each page which, when played back, would be difficult or impossible to read. On the plus side, all of the photographs in the encyclopedia could be reproduced beautifully with space left over, since each photograph would take up only one of the 54,000 frames available on a videodisc side.

The CD-ROM, on the other hand, would store the actual textual content of the encyclopedia quite well and could present it in the same way that a computer brings up text on the display screen. The limitations of digital storage become evident when attempting to reproduce the photographs. Although they could be digitized and stored on the CD-ROM, because of memory limitations, digitized photographs would not look as good as analog video images. In addition, they would take up a lot of disc memory and would drastically reduce the amount of other information that could be stored on the disc.

Digital Optical Disc

Technically, all forms of optical disc that store digital information, such as the CD and CD-ROM, and now CD-I and DVI, are digital optical discs. However, the 12- and 14-inch optical discs used to store records and documents in digital form seem to be taking the name "digital optical discs"—although many people simply call them optical discs. Therefore, in the medical records community, optical disc and digital optical disc take on a specific meaning as opposed to a generic one.

The storage capacity of digital optical discs is tremendous. The 12-inch digital optical disc manufactured by Philips holds one to two gigabytes (1-2 billion characters)—the equivalent of up to one million documents containing an average of 2,000 characters each. A 14-inch digital optical disc by Kodak can hold up to 8 gigabytes—four times the capacity of original optical discs. (The record keeping community also likes to use a "k" in their optical disk. In this book, all references to optical discs will be with a "c"—the "k" being reserved for magnetic disks).

Videodisc: Capacitance Format

There are two different kinds of videodiscs: optical and capacitance. Optical discs use a light source (laser) to read information on the disc while capacitance discs are read with a stylus that actually touches the disc. The two differ in the same way that phonograph records differ from compact discs (CDs).

Each family of videodisc can be further divided into two different formats. The two capacitance videodisc formats are CED (Capacitive Electronic Disc) and VHD (Video High Density). The CED was a grooved videodisc system developed by RCA that played movies and other linear material, but was not designed for interactivity. It was sold to consumers in the early 1980s as the Selectivision system before being abandoned in 1984.

The VHD is a grooveless disc system developed and marketed by Matsushita/JVC. VHD discs can accommodate up to one hour of material per side without loss of special features such as still-frame and fast-forward. The format is available in consumer and industrial markets in Japan and industrial markets only in the U.S. and Europe. The same

VHD player is able to play both NTSC (U.S. television standard) and PAL (Europe television standard) videodiscs.

Videodisc: Optical Format

The first optical videodisc player was introduced in 1978. The two optical videodisc formats currently available are reflective and transmissive. Each format can hold 54,000 still frames per videodisc side—up to one hour of motion video—and can access any one of those frames in seconds.

Transmissive Optical Videodiscs

Transmissive optical videodiscs are transparent and allow the laser light to pass through to the decoder. The format was developed in the late 1970s by Thomson/CSF in France, which also produced a player that could read both sides of a disc (without turning it over) by changing the focus of the laser. The Thomson format has since been discontinued.

Another transmissive system on the market until recently was the LaserFilm system developed by the McDonnell Douglas Electronics Company (MDEC). The LaserFilm is a photographic film-base disc that is designed to be inexpensive to update. The format has the ability to include up to 29 seconds of compressed audio for every still frame. The LaserFilm system is not compatible with reflective optical videodisc formats.

Reflective Optical Videodiscs – The Industry Standard

Reflective optical videodiscs have information stored as microscopic pits which are burned into a reflective metal surface. The metal disc is then coated with layers of polymethyl methacrylate (PMMA) to protect the coded information from surface dirt and scratches. To read the information, reflective videodisc players reflect a laser light off the surface of the disc, which is then read by a decoder.

The industry standard for reflective videodisc is the LaserVision (LV) format—used by Pioneer, Philips, Hitachi, Sony, and others. Within the LaserVision format, there are two different and incompatible ways to store and read information on the disc. The CAV (Constant Angular Velocity) disc stores information in a pattern that requires playback where the disc rotates at a constant speed (1800 rpm NTSC, 1500 rpm PAL) regardless of which portion of the disc is being read. The CLV (Constant Linear Velocity) disc is an alternative format that allows for more playing time than the CAV format, but without many of the special effects (eg. still-frame, slow-motion). With the CLV format, information is stored so that the disc speed varies between 600 rpm and 1800 rpm, depending on the area of the disc being read. Fortunately, most videodisc players can play both CAV and CLV formats, so compatibility is not a problem.

Compact Disc (CD)

The compact disc (CD) was first introduced to the public in 1982 as an alternative to prerecorded records and tapes. Also known as the CD-A (compact disc-audio), the disc weighs less than an ounce, is 4.75 inches across, and holds seventy-four minutes of recorded sound—the quality of which has never before been attainable. The compact

disc stores audio information in a digital format, which eliminates extraneous noise. Since it is read by a low power laser, disc wear is practically non-existent.

Several million CD players and more than 70 million discs were sold in the first few years the product was on the market. Players that sold for \$1000 a few years ago now cost between \$100 and \$200. Disc prices have dropped from \$20 to \$13 each. For a while, the supply of new discs lagged behind demand, and new replication plants were popping up all across the country.

Compact Disc Read Only Memory (CD-ROM)

With the success of the CD for mass replication and distribution of high fidelity sound recordings, many people were looking for the technology to go one step further and provide a format that could also store information for the microcomputer. Philips and Sony moved quickly to extend the CD technology to accommodate digital data and program files, and, at the 1984 COMDEX exposition, introduced the first compact disc-read only memory (CD-ROM) systems.

The CD-ROM is based on the same technology as the audio CD, using a different storage format and players. It was designed to serve as a microcomputer disk drive, and can hold up to 550 megabytes of information, or roughly the equivalent of 1,500 double-sided, double-density magnetic floppy disks. Like the CD, CD-ROM discs are inexpensive to replicate in mass quantities, making them the data storage medium of the future.

The first use of CD-ROM in medicine is the storage and retrieval of medical data bases which are usually stored on microfilm or main-frame computers. By the end of 1988, at least 52 health-related products were available on CD-ROM, with many more in the planning stages. These are covered in more detail in the chapter entitled *CD-ROM*.

CD-ROM Standards

Philips and Sony "own" compact disc technology and, therefore, enforce the technical standards through world-wide licensing agreements. The original CD standards, known as the Red Book standards, are fully disclosed only to licensees. Another set of technical standards were required for the CD-ROM technology to cover information representing alphanumeric files and bit-mapped images. Known as the Yellow Book standards, this information deals with the physical recording of data on the disc (sector and block sizes, error correction protocols, etc.).

However, Philips and Sony did not specify volume, directory, and file format standards for the CD-ROM so the computer would know where to find the information. That was left to the respective manufacturers of CD-ROM software and electronic information products, with predictable results—incompatibility among the products offered by major suppliers.

Fortunately, in late 1985, an ad hoc industry group, later dubbed the High Sierra Group, met at Lake Tahoe to discuss the development of CD-ROM standards. Representatives from Reference Technology, DEC, Microsoft, LaserData, and other companies worked to coordinate their activities with those of the National Information Standards Association (NISO), and the European Computer Manufacturers Association (ECMA).

Many manufactures are now adhering to the High Sierra Standards and it is becoming the industry-wide standard for CD-ROM technology. In 1987 Microsoft announced the availability of extensions to the MS-DOS operating system that support the use of CD-ROM disc drives with personal computers. They allow any computer that runs MS-DOS 3.1 or higher and has a CD-ROM drive to read discs in the High Sierra file format.

Mixed-mode CD (MM/CD)

In August 1988, IBM and Phillips/DuPont Optical (PDO) introduced yet another variation of the CD format: Mixed-Mode CD (MM/CD). The MM/CD is a combination of two existing standard formats recorded on a standard 5 1/4-inch optical disc. One portion of the disc is recorded in standard High Sierra CD-ROM format, while another portion of the disc is recorded in standard CD-Audio format.

This combined format allows more flexibility when creating interactive videodisc presentations. The MM/CD contains large information files, high resolution graphics, and CD audio which can be played over videodisc still frames. This extra capacity becomes especially useful with the development of large visual collections, or "generic" videodiscs, which contain thousands of still images and may require a computerized index which takes up several megabytes of memory.

Medical Application Used to Demo System

To illustrate the potential of this application, Dr. Ken Broda of Duke University recorded audio explanations of several slides from the *MDR Shared Disc: Resource In Medical Education II*, distributed by Stewart Publishing, Inc. This audio was replicated on the MM/CD by PDO using a new proprietary technique called *CDAssist*. IBM designed and authored a presentation for the InfoWindow system that presented a sample section of a medical training application using a hypermedia approach to material pertaining to brain pathology.

The presentation showed examples of audio coming from the mixed-mode CD-ROM player, video still and motion segments coming from the videodisc player, and computer graphics and programing logic which were stored as part of the data on the CD-ROM. In addition, the entire database for the *Shared Disc* was recorded on the CD-ROM.

Compact Disc-Interactive (CD-I)

During the First Microsoft CD-ROM Conference (March 1986) Philips and Sony announced that they were developing standards for a new medium based on the CD and CD-ROM technology. The new medium, called compact disc-interactive (CD-I), is designed to be fully compatible with CD-ROM formats, while, at the same time, adding new capabilities. Combining these capabilities with low-cost, compact delivery systems, the new technology is expected to impact on the education/training, point-of-purchase, and home entertainment industries.

The CD-I is able to store and play back various levels of video, graphics, audio, text information, and computer program code, all in a digital format. The CD-I specifications call for two video modes and several graphics modes. Originally, video was best stored and played as still-frame pictures, with motion sequences limited in size (1/9th of the

screen), and speed (6 frames/second). However, in May 1989 Philips announced the addition of full-screen, full-motion video capability which would allow up to 75 minutes of video to be stored on a CD-I disc.

Graphics may be stored in red-green-blue (RGB) format for up to 32,768 colors, or using a color lookup table (CLUT) with 256 colors. CLUT graphics are well suited to full-screen animation while RGB graphics may be manipulated by the viewer using paint programs.

Audio can be stored in seven modes with four different quality levels. The highest quality level is equivalent to that achieved with the CD, with a maximum of 72 minutes stored on the disc. Each level of audio—CD standard, Hi-Fidelity, Mid-Fidelity, and Speech Mode—requires decreasing amounts of storage as the fidelity decreases. Using the lowest fidelity, the speech mode, it is possible to store more than 19 hours of audio.

The specifications for CD-I are outlined by Philips and Sony in what is called the *Green Book*. These specifications assure that 1) CD-I and CD-ROM will remain compatible, and 2) players will be standardized to play both formats. CD-I is intended for markets much broader than those represented by today's microcomputer users, with references being made to a "smart viewer," a box that resembles a television that has no keyboard or evident disk drives. The assumption is that the CD-I will be inside the "smart viewer" and a touchscreen, keypad, or mouse will be used to control the microprocessor. While CDs were designed for high-fidelity audio, and CD-ROM as a computer disk drive, CD-I is projected to be the "ultimate home information and entertainment system of the future." The first CD-I applications are expected on the market in 1990.

Compact Disc-Video (CD-V)

In late 1986 Philips and Sony Corporation announced plans for a compact disc with video capabilities, or CD-V. CD-V is capable of holding five minutes analog video and up to 20 minutes of conventional CD audio. At the same time the CD-V was announced, Philips/Sony also announced the development of a new three-inch compact disc with video that will be used in the consumer market for short video clips. In order to distinguish what they call the "Video Single" from the existing compact disc, it is gold in color.

Philips acknowledged that the CD-V is a "renewed attempt to revive the videodisc." Industry experts expect the key to the acceptance of the CD-V will be the "omni player," a laser disc player that can read CD's, CD-V, and conventional 8- and 12-inch videodiscs.

Compact Video Disc (CVD)

Interactive Video Systems (IVS) announced in late 1986 the development of a new and competing video format called Compact Video Disc (CVD). Built around a 12 cm, CD-ROM-sized videodisc format, the system is able to hold 20 minutes of analog video in CLV format, 12.5 minutes in CAV mode, or 22,000 still frames. According to IVS president Michael Siegel, the CVD system can be used in both the consumer or commercial markets. CVD players will also play standard CD-audio and CVD discs may be used in conventional "mini-jukeboxes" now marketed for CD-audio by adding IVS's special decoding circuitry and high-speed drives.

Digital Video Interactive (DVI)

Announced at the March 1987 Microsoft CD-ROM conference was another disc format that will undoubtedly win the competition with the CD-V and CVD formats. GE/RCA Laboratories developed a format called Digital Video Interactive, which offers up to 72 minutes of full-motion, full-screen digital video, three dimensional motion graphics, and high-quality audio.

DVI uses two very large-scale integration (VLSI) chips that control the pixel-processing and display-processing capabilities. One chip is used to compress the video signal. Each frame is reduced to about five KBytes. Previously the amount of memory needed to store video frames was prohibitive. The second chip decompresses and displays the video. Potential applications for DVI include home entertainment, education, and commercial applications such as training, simulation, and video data storage and processing.

DVI Acquired by Intel

Intel Corporation announced in late 1988 that it had acquired the DVI Technology Venture from General Electric Company. The DVI Technology Venture, located at the the SRI David Sarnoff Research Center in Princeton, New Jersey, became an operation in Intel's Microcomputer Components Group.

A three-phase program was outlined by Intel. First, Intel was to set up a Technology Center in Princeton, New Jersey to facilitate DVI acceptance, solicit customer requirements, disseminate technology information, and support application development.

In the second phase, beginning in 1989, Intel will be cost-reducing existing DVI products and working with strategic partners and developers to proliferate the technology and motivate applications development. One of these partners is IBM, which signed an agreement to develop Micro Channel Architecture board products that will allow Intel's DVI technology to be used with IBM's PS/2 computer family. As part of the development contract, IBM will work with Intel to help define new DVI technology products, including boards, software and integrated circuits.

Phase three will occur in the 1990 timeframe when Intel brings out low-cost, highly integrated DVI products based on a new Intel DVI chip set.

Optical Card

Although the optical card is not an optical disc, it is included here because it is based on the same technology and is bound to have an impact on medical information storage and retrieval. The optical card is the size of a credit card and has a metal strip on which a laser reads and writes information in the form of microscopic pits.

The optical card can store from one megabyte to 200 megabytes of information per card. This equals up to 62,000 typed pages of information. The card is write-once-read-many (WORM) technology and may be updated (but not erased) as long as there is space available on the metal strip. The cards cost between \$3 and \$5 each to produce, with read-write units costing less than \$1,500 each. Read-only units are significantly less, with a price near \$200 each.

Applications for optical cards in healthcare include use as medical IDs, insurance IDs, outpatient cards, and medical records systems. Several companies around the world are already planning health-related uses for the optical card. More on this topic is presented in the chapter entitled *Information Systems*.

Interactive Videodisc Systems

Interactive videodisc systems come in a variety of configurations, depending on the use for which it is intended. They can range in complexity from a low-end of a single videodisc player and keypad to a middle-ground of a fully integrated system such as the IBM InfoWindow. High-end systems would build on the InfoWindow configuration by adding peripherals such as a CD-ROM drive, digitizing boards, and more. To better understand the different configurations, it is useful to classify them according to the levels of interactivity defined by the Nebraska Videodisc Design/Production Group in 1980:

Level I Systems are simply stand-alone videodisc players which can be controlled using either a remote control or, in the case of some Pioneer players, a barcode wand. The interactivity is limited to what the viewer can do using the videodisc player controls only—still/freeze frame, picture stop, chapter stop, frame address, and dual-channel audio features. There is no computer processing involved.

Level II Systems are simply videodisc players equipped with a microprocessor which can load and deliver a limited amount of programming instructions that have been encoded onto the videodisc. Level II provides some programming features such as branching at multiple choice questions, continuous video loops, and the like.

Sony and Pioneer both sell Level II videodisc players, but each company has its own programming language which must be encoded onto the videodisc. Therefore, Level II videodiscs coded for Pioneer players will not play on Sony Level II videodisc players, and vice versa. One solution to this problem is to encode programming for both Sony and Pioneer onto the same videodisc.

Level II videodisc players cost approximately twice as much as Level I videodisc players, and developing Level II discs requires additional time and expense to design and code the programming that is to be pressed onto the videodisc.

Level III systems consist of Level I or Level II videodisc players connected to an external computer—usually through a parallel port via an RS-232C cable. Level III, like level II, provides programmed instruction. However, because the capabilities of the external computer are greater than the processors in Level II players, Level III programs can be far more sophisticated. Computers commonly used in Level III systems are IBM PC (and compatibles) and the Apple computers.

With simple Level III systems, there are two monitors: one for the computer text and one for the videodisc image. With other Level III systems, the computer text and the videodisc image are combined using a graphics overlay board, resulting in a one-screen system. Both two-screen and one-screen systems are popular in health sciences settings, depending on the needs of the discipline and the content of the software.

Level IV and above has been proposed by some people to describe the addition of peripherals such as CD-ROM drives, digital video and audio, etc. However, the industry

has not settled on any single standard for these higher levels which, technically, all fall into the Level III category.

Two-screen Videodisc Systems

Generally, two-screen videodisc systems are driven by either an IBM-PC compatible computer or an Apple Macintosh computer. With two-screen systems, the computer text/graphics appear on one screen, while the videodisc image appears on a separate monitor. These systems are most common in medical fields where there is a large number of still images—such as radiology, pathology, or hematology. In this way, an image can be up on one monitor while text or graphics explaining the image can appear simultaneously on the other monitor.

Two-screen Compatibility. Before the introduction of Apple's *HyperCard*, most two-screen applications were designed for PC-compatible systems. Now, however, due to the ease with which non-programmers can create and exchange instructional materials using *HyperCard*, as many as 30 percent of the two-screen systems used in medical schools are driven by Macintosh computers.

Another area which creates compatibility problems using two-screen systems is the videodisc player. Each manufacturer uses its own programming commands to drive the videodisc player, necessitating the inclusion of several videodisc "drivers" in most software programs. A second, and less common, area of incompatibility arises when a software program is written to take advantage of a feature found in a specific model videodisc player (such as digital frame store available with the Pioneer LD-V8000) which is not available in another player.

One-screen Systems

For many interactive video applications, it is desirable to combine the text and graphics of the computer with the video image from the videodisc player. Doing so not only reduces the number of monitors needed, but also allows for any number of special effects—such as computer generated graphics or text being placed on top of a video image. However, since the computer output and video output are not compatible with each other, graphic overlay boards were developed to achieve the mix.

For many years, there were dozens of graphic overlay boards on the market, none of which was compatible with the other. This meant that in order to play a program developed by someone else, you had to purchase the specific graphic overlay board which they used when developing the program. Clearly, this presented a problem for anyone who wanted to play programs developed by several different sources.

Finally, in 1987, IBM introduced the InfoWindow system, a combination of computer, overlay board, videodisc controller, and touchscreen monitor designed specifically to deliver interactive video programs. As more videodisc courseware was developed to run on the InfoWindow system, other hardware manufacturers began emulating the IBM systems so that "InfoWindow compatibility" became a selling point for their systems. Today, the InfoWindow is the standard for which almost all software manufactures program.

Today, there are at least five hardware delivery systems which play courseware designed for the InfoWindow: IBM InfoWindow, Sony VIEW System, FITNE System, Visage

System, and the Video Associates Labs system. These systems list between \$7,500 and \$11,000, depending on the manufacturer and the options purchased, but can be purchased for between \$6,000 and \$7,000 with various discounts.

IBM InfoWindow System

The original IBM InfoWindow System differs from all the other systems in that the graphic overlay and controller board is located in the touchscreen monitor instead of in the computer. The InfoWindow monitor can be connected to any IBM-compatible computer (PC/XT/AT) with the addition of special EGA graphics and jumper cards. The InfoWindow monitor lists for \$4,195. With additional cables, software, and videodisc player, the total system lists for approximately \$11,000. Discounts are available to educational institutions.

One disadvantage of the InfoWindow system is the fact that most sales representatives package it with the most recent IBM computer. As of January, 1990, this includes the PS/2 Model 30-286 or the PS/2 Model 50z. The problem arises because there are differences in the bus architecture and chip speeds in these computers, and many software firms cannot keep up with the rapid changes. This results in many software problems for schools with PS/2 computers which attempt to run videodisc and computer-assisted instruction programs designed for earlier model computers. Schools with InfoWindow systems built around the original AT or compatible computers do not experience these problems.

As of December, 1989 IBM is expected to announce a new InfoWindow system which will feature a VGA overlay board for the computer, allowing the use of a number of touchscreen monitors with the system. Details regarding other features and the system cost are not known at this time.

Sony VIEW System

Sony Corporation has the only truly integrated videodisc system in the VIEW-5000. This is because Sony has put the computer and LDP-1200 videodisc player into the same case, reducing both the space and number of cable connections needed.

The most notable features of the 5000 is its IBM InfoWindow emulation and its lower price. Though the basic unit lists for only \$4,995, the addition of a Multiscan monitor (\$995) or touchscreen monitor (\$1,875) and 40MB hard disk (\$975) will run the list price of the system closer to \$8,000.

In addition to InfoWindow emulation, the 5000 provides CGA, EGA, and VGA graphics compatibility, a lightweight/compact design, advanced graphics capability with 256 simultaneous colors at 640 x 480 resolution, and a flicker-free non-interface display. The computer is a 286 compatible running at 8MHz or 10MHz with 640K main memory, 256K standard graphics memory, and a 3.5-inch floppy disk drive.

FITNE System

Designed by the Fuld Institute for Technology in Nursing Education (FITNE), the FITNE system is built around an AT compatible, 8 MHZ-80286 computer with 5.25-inch floppy and 20 MB hard disk drive. A VAL Microkey/Mark 10 graphics overlay board is in-

stalled and drives a Mitsubishi 14-inch color monitor with an Elographics Intellitouch Screen and a Pioneer LDV-4200 videodisc player.

Emulation software allows the FITNE system to run software programs written for the IBM InfoWindow. The big advantage of the FITNE system is the support, which includes the promise to provide replacement systems while the original is being repaired. The system lists for \$7,349

Visage System

Visage, Inc. recently announced the development of an IBM InfoWindow-compatible system. The system consists of an AT-compatible Everex 286 12 MHz computer with one MB RAM, 40MB hard drive, and 5.25 floppy disk drive. Along with a Sony LDP-1200 videodisc player and the Visage controller and overlay board, the Visage system lists for more than \$7,000, but is available for much less. As with the Sony and FITNE systems, emulation software permits the Visage system to run videodisc software designed for the IBM InfoWindow.

VAL System

Video Associates Labs, who provides the graphic boards and InfoWindow emulation software for the FITNE system, is the latest to be working on an InfoWindow-compatible system. The unique feature of this system is a removable cartridge which contains the hard drive. This solves the problems of how to load many videodisc programs—which can require as much as 20 MB each. Pricing information was not available as of December 1989, but the system is expected to be competitive with the other integrated systems.

One-screen Macintosh Systems

Although there are a number of graphics overlay cards available for the Macintosh, none of the cards is compatible with each other. Therefore, Mac users are suffering from the same problems PC users had to live with until the standardization around the InfoWindow. Although one-screen applications are being developed for in-house use at some medical schools, until standardization is achieved, Mac-based interactive video courseware intended for distribution will be designed for two-screen Mac systems.

Dedicated/Proprietary Systems

In an attempt to provide all of the benefits of Level III interactive video without the high cost of the hardware systems, some commercial vendors have assembled proprietary videodisc systems which they can offer clients for as little as \$1,500. These systems usually consist of a proprietary computer, videodisc player, overlay card, and some form of input, often a customized keypad.

The advantage of this type of system is the low cost. The disadvantage lies in the fact that the system will play only courseware provided by the single vendor, and will not play any of the programs which can be bought "off the shelf."

In some specialized markets this is not a problem because the user is buying a dedicated training program. An example of this is the ProCare training curriculum developed by Professional Training Systems (PTS) in Atlanta, Georgia. This curriculum consists of 34 different videodisc modules designed to train nurse assistants in nursing homes to suc-

cessfully take a written competency evaluation required for certification. In this highly selective and focused market, the inexpensive, proprietary delivery system offered by PTS is a reasonable alternative to the more standard, and much more expensive, InfoWindow-compatible systems.

An attempt to place proprietary systems in as many as 300 hospitals across the country is being made by Argosy Network Corporation. Argosy plans to deploy a network of interactive learning stations which will be fed program software over telephone lines from the Argosy office in Nashville. Medical product manufacturers and pharmaceutical companies will provide the courseware to be used, while the hospitals will receive the hardware free and pay a fee only as each program is used by staff members. A testing phase was due to be completed at the end of 1989, with full-scale implementation to take place throughout 1990.

Related Components

Videodisc Players

There is a wide variety of videodisc players available, from consumer models to educational and industrial models. Most educational and industrial models have an RS-232C interface which allows the player to be connected to an external computer. As mentioned earlier, there also are Level II players with a small microprocessor built in which allows for a limited amount of programming to be loaded from the videodisc.

The most popular videodisc players are from Pioneer, Sony, and Hitachi. The least expensive models used with interactive videodisc systems are the Pioneer LD-V2200 or LD-V4200 and the Sony LDP-1200. These players include an RS-232C interface, have an access time (longest time it takes to go from one frame to another) of three to four seconds, and cost between \$895 and \$1,095.

When additional features or Level II capability are needed, the most popular players are the Pioneer LD-V6000A or LD-V8000, or the Sony LDP-1550. These players improve access time to less than two seconds and include multi-track jumps which allow instant frame jumps within a 100-200 frame area. This class of videodisc player sells for between \$1,598 and \$2,280.

Input Devices

Level III videodisc interaction requires input to the computer from the user. This input may be entered through several different devices: 1) computer keyboard, 2) touch screen, 3) light pen, 4) mouse, 5) voice recognition and 6) scanning wand to read bar code workbooks. Computer software often must be written specifically for each input device, creating some compatibility problems. Even products within each group are not necessarily compatible with each other. For example, there are several different types of touchscreens, each of which requires a different program code to control.

By far, the computer keyboard and touchscreen monitors are the most popular methods of user interface, or input devices. Little research has been done to show if one form of input is more effective than another for any given situation. However, the touchscreen is considered the most "user friendly" form of input in that it requires no typing skills and allows the user to keep his or her eyes on the program at all times. The

light pen acts much as the touchscreen monitor does, with the pen taking the place of the viewer's finger in touching the screen. Voice recognition technology is in its infancy, but has already been used by the National Library of Medicine to produce a prototype videodisc program.

The scanning wand, or barcode reader, has been used in developmental projects by both the American Medical Association and the National Library of Medicine. Recently, however, Pioneer has made a barcode reader and development software available that makes it easy to encode textbooks and manuals with barcode images. In this way, a user would simply run the reader across the image and the selected videodisc image would appear on the monitor. This form of user interface is bound to gain popularity, and is already finding acceptance in some schools and by some videodisc producers.

Authoring Systems

Authoring Systems are tools used by non-programmers to create computer-based instruction. They lead courseware developers through a composition process, providing menu choices and prompts, then generate the underlying programming code. Authoring systems are easier to use than authoring languages, and allow people to concentrate more on designing the lesson than on the necessary programming steps.

There are more than 70 authoring systems on the market, with a great variance in program complexity, capability, and price. Features of authoring systems include the ability to create and edit graphics, guide the user through instructional design, judge student responses, and keep records of student interaction. Contracts vary with different authoring systems, some with hidden costs for additional drivers, run-time versions, or annual fees. Each authoring system is also designed to be used with specific hardware components, with most supporting several configurations.

Costs vary a great deal, depending on the features offered by the system. Apple's *HyperCard* sells for only \$49 and is suitable for basic instruction or database organization. More sophisticated authoring systems which allow you to program complex simulations using touch screen and graphic overlay technology will cost more, with the average price being between \$1,000 and \$2,500.

Hypermedia

Hypermedia is a term which has appeared since the introduction of hypertext authoring systems such as Owl International's *Guide* and Apple's *HyperCard*. Hypertext is an exciting way to organize and present large amounts of text, graphics, and images by "linking" each to one another so that the user can easily move around among them.

The following discussion of hypermedia is abstracted from presentations made at the Interactive Healthcare 89 conference, which took place June 3-6, 1989 in Alexandria, Virginia. The topic of hypermedia dominated the final day of the conference, which was highlighted by three presentations and a panel discussion on the uses of various hypermedia applications in medical education.

Guide Vs HyperCard. Sharon Dennis (Hahnemann University) compared the use of *HyperCard* versus *Guide* as an authoring tool, calling the decision a "very painful" one to

make. Working with some of Hahnamann's biochemistry faculty to convert their course manual to computer-based instruction, Dennis developed prototype Macintosh programs that used both *Guide* and *HyperCard*. She first demonstrated the *HyperCard* prototype which presented a Hemoglobin Gas Transport tutorial. The tutorial presents an overview and 11 topics of study, and makes use of graphics, exam questions, short answer questions, and "many more surprises."

The *Guide* prototype featured a program on Enzymes, with information divided into three main topics of study. "This program uses many of the same features as the *HyperCard* prototype," said Dennis, "but notice that *Guide* uses a scrolling window approach whereas *HyperCard* uses a flipping card approach."

Dennis went on to describe the other differences between the two systems. *Guide* uses a document metaphor. "Think of *Guide* as a book that can be interlinked," said Dennis. "*Guide* is good if you already have lots of text that needs to go into a program."

HyperCard, on the other hand, uses the metaphor of the index card, and the cards all can be linked. "You cannot have scrolling information on a *HyperCard* card, although discrete chunks of information can be interlinked easily," explained Dennis. *HyperCard* is best suited to present information in a structured, organized manner.

Another major difference lies in programming capabilities. *Guide* is set up very much for hypertext only. It can't truly be programmed. *HyperCard*, meanwhile, does have full feature programming, which permits the user to program short answer questions, card flipping animation, and so forth. It cannot, however, be used to write a full-featured Macintosh program. (Dennis stressed the new *SuperCard* program will add the ability to take *HyperCard* stacks and make "real" Macintosh programs that use the complete Macintosh interface.)

Guide is available for both the Macintosh and MS-DOS environments, while *HyperCard* works only in the Mac environment. "If you have no Macintoshes at all, you will have to go with *Guide*," said Dennis. "With the possible exception of *Linkway*, there really is no *HyperCard* for the PC." For mixed environments, a translation facility is available from *Guide* for \$150.

Unlike *HyperCard*, *Guide* works on a large screen and in color. It will open as many as 32 documents simultaneously, whereas *HyperCard* can open only one at a time. *Guide* offers multiple, resizable, and relocatable windows. *HyperCard* does not. Furthermore, *Guide* uses the standard Macintosh interface, but *HyperCard* does not. (The introduction of *SuperCard* may make many of these differences obsolete, however. *SuperCard* can open multiple windows. It will allow users to colorize stacks and put them on a large screen, and will use a standard Macintosh interface.)

Dennis observed that the systems are similar in that they both offer easy integration of other programming tools. "I also believe," Dennis said, "that *Guide* and *HyperCard* are about equal when it comes to using a videodisc player."

One of *Guide*'s true advantages lies in its "sticky button" feature, which is essentially the ability to define buttons which stay in their proper places regardless of changes made to the scrolling text. *Guide*'s second major advantage is its ability to add new information easily. *HyperCard* requires extra programming to accomplish either task. "As far as I know, *SuperCard* has not added sticky buttons," said Dennis.

Dennis concluded her comparison by saying, "There is a need for more study regarding user reactions. We need to do an in-depth study and compare a *Guide* application with a *HyperCard* application, and compare the students' ability to learn the information quickly using both of these media. We need to ask, 'Is this better? Is this working?'"

Hypermedia Panel Discussion. F. Scott Beadenkopf (Thomas Jefferson University) addressed these and other questions in a panel discussion on Hypertext Authoring: A Look at the Options. Other participants on the panel were Lawrence Spero (University of Toronto), Joel Weinstein (Case Western Reserve University), and Alister Gibson (OWL International).

In his opening remarks, Beadenkopf said, "The whole purpose behind hypertext is to have an information access tool, not to program learning the way we've done in the past. I think the ideal CAI program is one that is very adaptive. But it takes a long time to write the kind of program that anticipates all the students' responses and problems. The alternative is to write a hypertext program which gives the student control over the content and path." What followed was an examination of various hypertext media: *Linkway*, *Guide*, *HyperCard*, and *SuperCard*.

IBM Linkway. Lawrence Spero began the discussion with an exploration of *Linkway*. "*Linkway* was designed as a hypertext medium for the K-12 school market, but was not seen by IBM as particularly useful in the university market," he said. "But I think you will find that *Linkway* has become kind of 'cult hit' among university developers."

Documents in *Linkway* are called Folders. *Linkway* makes use of VGA graphics and 300x200x256 color capabilities to provide very natural looking digitized images. The program permits the creation of buttons that are operated with a mouse and that can be pasted into documents to control such things as sound, graphics, and peripherals. It features five levels of security: a run-time module (free with *Linkway*), read-only mode, free and open mode, update mode, delete mode.

Changes may be made to Folders without changing interactions among pages. An object-oriented system, *Linkway* permits the creation of buttons, which may be stored for later use, and are very flexible. "You can create a window, put an object in it, then move the entire thing anywhere in the folder. It's very powerful," said Spero, and compared the feature to *Guide*'s 'sticky buttons.' *Linkway* can use any number of external programs and will "do anything you'd like to do on an InfoWindow system."

Linkway uses a card-style format, but because cards also can be scrolled, the program sits halfway between *Guide* and *HyperCard*. Priced at \$100 for single units, *Linkway* also is available in network versions. *Linkway* does not run under Windows and requires the use of a mouse. It currently is limited to Sony videodisc players and the Pioneer 6000 series, but drivers are being written for other videodisc players. A *Linkway* toolkit (\$300) adds a sort routine, map routine, and vector graphics capability. The kit is not necessary to use *Linkway*.

Spero stressed *Linkway*'s simplicity and predicted that one day, users "will begin exchanging *Linkway* 'stacks' like people are exchanging *HyperCard* stacks now."

HyperCard and SuperCard. Joel Weinstein continued the hypertext debate with a review of *HyperCard* and *SuperCard*. "Having worked with *HyperCard* since its inception, I am well aware of its limitations," said Weinstein. He briefly described *HyperCard*'s short-

comings (offers no color, doesn't fill up the entire screen on a Mac II, allows only one window to be opened at a time, and uses a two-bit black-and-white display mode) and then told how SuperCard will remedy many of these problems.

Consisting of two applications (*SuperEditor* to build applications and *SuperCard* to run applications), *SuperCard* offers the ability to create more flexible buttons (in terms of shape and color), new development tools, and a run-time module. It comes with a stack of tips and techniques, which detail how to design good *SuperCard* stacks. In addition, *SuperCard* allows conversion of HyperCard stacks to *SuperCard*. It uses the Supertalk language, which is a superset of Hypertalk.

A significant improvement offered by *SuperCard* is the addition of color. *SuperCard* takes the two-bit black and white mode and makes it into an eight-bit, 256 color program. Also, the paint capabilities of *HyperCard* have been improved upon, giving *SuperCard* an object-oriented paint program. Furthermore, *SuperCard* takes away any constraints on window sizes and on the number of windows or cards that can be opened simultaneously.

Weinstein also pointed out that with *SuperCard*, "any object can be a button. Everything has a script - fields, graphics, buttons, cards, and every object on the card." This added feature simplifies the reorganization of cards within stacks, and improves animation capabilities.

However, Weinstein said, *SuperCard* does have its disadvantages: "The more powerful the program, the more difficult it is to design an application in." Unlike *HyperCard*, where editing and presentation is accomplished in the same mode, *SuperCard* buttons don't work in the editing mode. The user has to close *SuperEditor* and open *SuperCard* in order to test or run an application. Another disadvantage is that in order to run color, *SuperCard* requires at least two megabytes of RAM. *SuperCard* carries a list price of \$199.

According to Weinstein, a committee has been formed to investigate standardizing Hypertalk and any extensions to Hypertalk. "Maybe," said Weinstein, "we'll see an MS-DOS program that uses Hypertalk."

Owl International's Guide. Alister Gibson then took the floor to provide some additional thoughts on *Guide*. "*HyperCard*," he said, "was introduced primarily as a means for users to construct programs—not so much as a hypertext tool but as an application construction set. *Guide* is different in its focus. It's not there to construct applications; it's there to manage 'continuous information.'"

Describing *Guide*'s 'sticky button' feature, Gibson said, "'Sticky buttons' are parts of the hierarchy of information. When you cut and paste a button, the structure goes along with it. The hypertext structure 'sticks' to the text and graphics, and the buttons move with the text as it is scrolled."

He informed the audience that OWL will release a major upgrade of the technology: the new *Guide* version will be available sometime within the next six months. As with current versions, the run-time module will be a separate application.

Following Gibson's brief presentation, the floor was opened to audience questions. Many in the audience expressed concern over the use of hypertext as a programming tool. "It's easy to create bad programs," said one participant, who questioned the wisdom of putting program design in the hands of inexperienced faculty members.

The panel, however, encouraged faculty members to take an active role in program development. "We don't want to inhibit anybody," said Beadenkopf. Others agreed, saying

that simplicity is the key to successful program design, and that simplicity is the hallmark of hypertext authoring. "While hypertext requires a different set of skills than word processing," said Beadenkopf, "I think it's certainly within anyone's capabilities to create a hypertext program."

The panelists encouraged schools to develop their own programs, and to make them flexible and updatable so that they may be shared among institutions. All the speakers agreed that careful planning is the key ingredient of good hypertext programs. As explained by Alister Gibson, in a typical hypertext project, half the developer's time is spent planning the structure of the information, 25 percent of the time is spent creating text and graphics, and only 25 percent on actual structuring of the information. "You're going to be sharing this information," Gibson said, "so do give a lot of thought to how you will present the information."

Authoring System Reviews

The following are reviews of a few popular authoring systems which are reprinted from various issues of *Medibytes*, the newsletter on computers in education produced by the Office of Academic Computing at Thomas Jefferson University, and which also appeared in the *Interactive Healthcare Newsletter* published by Stewart Publishing, Inc. The reviews were written by David Haynes and Scott Beadenkopf.

REVIEW: COURSE OF ACTION

One of the newest and most complete authoring systems for the Macintosh is *Course of Action* from Authorware, Inc. Unlike *HyperCard* or *Guide*, *Course of Action* was designed specifically for writing education applications, though it could be used for virtually any kind of presentation. It gives the instructor the ability to ask questions of any type (with or without time limits), give feedback, branch to other lessons, and even have pulldown menus. Authoring is done using a structured flow-chart approach to development that forces the instructor to organize the course before programming it.

The most basic *Course of Action* package consists of the authoring system complete with enough options to create and deliver standard tutorial and question/answer sessions. For fancier CAI there are also options available for animation, digitized sound, and videodisc or CD-ROM control. Options can be purchased separately or all together in what Authorware calls *The Best Course of Action*.

There are more features to the program than can be covered here, so let's just look at some of its unique qualities:

Direct Editability. While the lesson is being presented, changes and additions can be made by just clicking on a screen object. If the author wants to reposition an object, it takes only a move of the mouse.

Answer Analysis. *Course of Action* has extensive interaction capabilities. The author can use text entries, mouse actions, pulldown menus, or function keys. Questions can be presented randomly, and time limits can be set. If a student is taking too long to answer a question, a hint can be given, or bonus points may be given for a quick response.

Concurrency. Perhaps one of the most impressive features of the program is its ability to allow several tasks to run on the screen at the same time. This means that an anima-

tion, or even several animations can be running while the student answers questions or views descriptive text.

Variables. Most authoring systems allow answer data to be captured to variables, an essential feature for student evaluation. *Course of Action* takes this one step further by introducing "system variable," "system functions," and "user variables." System variables allow data to be retrieved for answer analysis. Over a hundred system functions allow data to be manipulated or plotted and provide an easy to use interface with many of the Mac's toolbox routines. As many user variables can be created as needed to store paragraphs or text of numbers for calculation.

Portability. *Course of Action* programs written on the Macintosh may be presented on IBM/PC-compatible machines through the use of Authorware's "transporter" program. This ability greatly increases the potential audience for a given course.

In short, *Course of Action* is a powerful and easy-to-use authoring system. The quality of a course created using this system, however, will depend largely on the quality of the preprogramming steps in the development process.

REVIEW: AUTHORWARE PROFESSIONAL

Of the authoring systems available for the Apple Macintosh computer, none has been as fully featured for educational software development as Authorware's *Course of Action* development system. *Course of Action* has been used successfully at Thomas Jefferson University for several projects, and has proven itself to be a reliable development system. One major reason why we at Jefferson were so interested in Authorware's products from the beginning was their bold claim that any course developed on the Apple Macintosh could be "ported" over to run on an IBM PC or compatible, maintaining all of the features typical of any Macintosh application such as the use of a mouse for pointing, pull down menus, and the attractive graphical interface. The PC transporter was promised over two years ago and finally arrived in July, included in Authorware's revitalized product *Authorware Professional*.

Authorware Professional is basically *Course of Action* with a face lift. It now supports 256 colors and the full 640 x 480 pixel Macintosh II screen, bringing it up to the current resolution standard for display graphics on the Macintosh. Other changes involve additions to the number of system functions and variables, support for additional videodisc players, *HyperCard* XCMD support, network compatibility, and a sound digitizer, as well as many subtle changes in program design. The new design makes program development easier and greatly increases usability.

The most significant addition to the program is, however, the ability to "port" a course developed on the Macintosh to an IBM compatible using Authorware's PC Transporter program, which comes with the *Authorware Professional*. Conversion is a simple process. Once a course has been developed, the "Transport to PC" menu item is selected and the course is converted and saved as an IBM compatible file. The second step is to physically move the file over to the PC, which may be done using the serial cable that is provided in the package, or even more simply, by using Apple's FDHD (Floppy Drive High Density) disk drive, which reads and writes to IBM compatible 3.5" diskettes.

A runtime program provided for the IBM then allows the course to run. Since most Macintosh programs require the use of a mouse it is advisable to have a mouse attached

to the IBM as well. During the conversion process, if the InfoWindow option is chosen, the transported program automatically makes use of the IBM InfoWindow touch screen instead of the mouse.

The Transporter is impressive. Programs ported to the PC mimic Macintosh programs almost identically. The quality of the graphics adapter greatly influences the appearance of the program, however, and ports look best on a machine with at least EGA capability. On a monitor using EGA resolution, the graphics appear quite clear, while at VGA resolution, the clarity cannot be distinguished from that of a Macintosh screen.

Authorware Professional should prove very useful to those who require not only the structured, flow chart approach to course authoring provided by the original *Course of Action* program, but also the high resolution color graphics necessary for many medical education applications.

REVIEW: SUPERCARD

About two years ago, Apple Computer distributed what was to become one of the most significant software products for educational computing of the decade—*HyperCard*. Since its introduction, thousands of novice programmers have created educational "stacks" for the Macintosh computer. *HyperCard* allows users to place "buttons" onto graphics without programming. When the buttons are clicked on with a mouse another predetermined screen or dialog box appears with more information on the graphic.

The program does have limitations, however. Around the same time that *HyperCard* was released, Apple's Macintosh II line of computers was introduced, allowing for greater speed, a 13" or larger monitor, and high resolution color. The release of this new line of machines immediately set a new standard for developers but, unfortunately, *HyperCard* did not support either color or a full-screen display. Many attempts have been made to compensate for *HyperCard*'s shortcomings, such as through the many XCMDs (external commands) that have been written to "pop up" color windows and give full-screen support. But it is still impossible to put a "button" onto a color image. *SuperCard*, from Silicon Beach Software, provides most of the features left out of *HyperCard*, particularly those related to using a full-screen color display, mainly because it supports much more of the Macintosh interface, such as allowing for multiple windows, pull-down menus, floating palettes, and animation. Again, many of these features can be accomplished in *HyperCard* through the use of external commands and external functions, but these must be implemented by experienced programmers.

SuperCard Programming. Users of *HyperCard* will find many differences between the programming environments of *SuperCard* and *HyperCard*. *SuperCard* is not, for instance, limited to a single "stack" of cards on the screen at once, but instead allows for multiple windows, each of which may be thought of as being roughly the equivalent of a *HyperCard* stack. The illustrations show the basic organizational differences between the two programs. This makes *SuperCard* much more flexible, because all of the windows may be linked together with the buttons. So, for instance, if a graphic of the thorax is placed in one window, buttons may be placed on that graphic so that if the user clicks on the clavicle, another window will show information on, or ask a question about, the clavicle. One window could be a stack of graphics and another window could be a stack of questions, with linkages between the two occurring in the "script" associated with each.

SuperCard's most significant feature is its ability to treat anything as a button. In *HyperCard*, buttons are always rectangular (with the exception of radio buttons, check boxes, etc.), and as a result, it is impossible to put a button over an irregularly shaped object. *SuperCard* uses the idea of "draw graphics" to overcome this problem. Using tools similar to those in *SuperPaint* (also a Silicon Beach Software product), one can easily trace out the area desired. After the area is traced out, double clicking on it brings up a box where the script resides. It is there that the graphic may be linked to another using commands as simple as "go to card ID 12."

Disadvantages of SuperCard. We have found several disadvantages of the current version of *SuperCard*, most notably speed and memory constraints. For most applications, primarily those with scrolling fields and color, the screen redraw is very slow (on the order of five to seven seconds). A typical redraw in *HyperCard* is much less than a second. Considering the amount of data in a color anatomical image, though, the delay is clearly understandable. Not understandable, however, is *SuperCard's* need for memory. The manual says that to use *SuperCard* in black and white requires one megabyte, and for color, requires 1.5 megabytes. On a machine with 2.2 megs, I was constantly getting "out of memory" messages, and even on a Mac IIx with 4 megabytes of RAM, memory errors are common. Overall, *SuperCard* is an impressive extension to *HyperCard* and represents the first program to enable color Hypermedia on the Macintosh. Another program, *Plus* (which makes the same claims as *SuperCard*), has been released recently, so it appears that there will be excellent tools for this kind of CAI development in the future.

REVIEW: LINKWAY

IBM's new hypermedia program, *Linkway*, has some nice features, but it is unlikely to raise a serious challenge to Apple's *HyperCard*. Written by Larry Kheriaty (of PC/PILOT fame), *Linkway* is an authoring system for creating hypertext documents for IBM and compatible personal computers. The documents are called "folders," and consist of pages that can contain pictures, text input or display fields, and buttons. As in *HyperCard*, buttons are areas on the screen that are activated by "clicking" the mouse button when the screen cursor is inside them. Buttons can turn pages, link to a page in another folder, show text or pictures, search for selected text, or launch a subprogram written in the Linkway scripting language. Again, as in *HyperCard*, buttons can be cut and pasted from one page to another.

The authoring system consists of mouse-driven pull-down menus from which one can open and close folders, create new pages and objects, set graphics mode and other options, and branch to the graphics editor. Images from IBM's Storyboard Plus graphics editor can be displayed directly by *Linkway*. A capture program is included that will capture displayed images from many other graphic editors and programs. The supplied graphics editor is competent but uses pull-down text menus and is therefore not as easy to use as Storyboard Plus or other editors with icon-based menus. A text editor is also supplied and can be accessed from a "document" button. A \$300 *LinkWay Toolkit* provides additional routines, including a fancy font library and support for the IBM music feature and InfoWindow system. Buttons for controlling some Pioneer videodisc players are included with the basic package, and the button scripts can be modified to accommodate other players.

Demonstration Programs. Included with the package are a number of demonstration folders: a "desktop" program with a To Do List, weekly and monthly engagement calendars, and a set of Sample Teacher Tools including a homework designer, flash cards, and a lesson planner. The demonstration folders used rather attractive graphics, but in IBM's MCGA graphics mode (320 by 200 pixels with 256 colors). They were not available in the higher resolution VGA/EGA mode nor in the old CGA mode. On a computer with a VGA card the demonstration automatically comes up in MCGA mode, the mode for which most of the folders have been written. (A separate *Linkway* folder must be written for each graphic mode.) The text was fairly ugly in the MCGA mode, but versions of the demonstrations for other modes had not been supplied with the reviewer's copy. When loaded onto a machine with an EGA monitor, most of the demonstration folders were not accessible at all. Because *Linkway* operates only in graphic modes it is somewhat slow.

On The Plus Side. The program is inexpensive and should be a useful tool for developers who cannot afford something better. It provides an easy way to create graphics-based informational programs with mouse/keyboard student interaction. User choice menus can be constructed without programming either through the creation of "link" or "go" buttons or through a "menu" command in the script language. *Linkway* might be used to create an attractive shell to coordinate a variety of processes. External programs and binary routines can be called from *Linkway* and can be given full control over the *Linkway* environment. Videodisc or telecommunications control can be programmed into buttons with the script language, though the language does not appear to be as English-like as *HyperCard's* HyperTalk.

On the Other Hand. Unless future versions of the program are significantly improved, *Linkway* will not be a big winner. The authoring interface is not intuitive enough for novices nor powerful enough for professionals. Most menu choices require too much mouse positioning, i.e., both a menu-selection click and a close-window click. Neither a double click nor the key can be substituted. Key combinations are not available as alternatives to mouse operated menu choices. There is no capability for generating reports for the author beyond printing individual screens or button scripts. Small touches make *Linkway* appear amateurish. For instance, scrolling text windows don't stop at the end of the text, but keep on scrolling. *Linkway's* help files all end with an informative "*** End of Help ***" line, but the text will continue to scroll out of sight if the button is held down. The ready-made icons are apparently drawn for all graphic modes, and consequently look crude in high resolution modes. A font/icon editor is included with the package, however.

Support. Ninety days of toll-free support is available to purchasers through an IBM helpline. My phone call was answered immediately by a friendly technician who said that he could not answer my question because the product was so new, but called back with the answer in 20 minutes.

Priced at \$110 for a single package with a 20 percent educational discount and very reasonable site licenses, *Linkway* is not a bad deal. For small programs or for prototyping larger programs, it may prove valuable. Because of the already available tools for MCGA mode, *Linkway* will probably be a hit in schools with large populations of IBM PS/2 model 30s. If the authoring environment is made more intuitive, *Linkway* could even become popular. Its limitation to MS-DOS, to graphic modes, and to the specific mode in

which folders were authored will not endear it to developers writing for a broad hardware platform, not a difficulty for programs which won't be distributed.

Chapter 2

Pharmaceutical Companies

For years, pharmaceutical companies were spending more on videodisc development than any other segment of the healthcare industry. As early as 1987, 30 different companies had produced more than 150 videodisc programs to be used as medical exhibits, sales training, and educational/promotional tools. This market has continued to grow over the past few years, with an additional emphasis on sales training.

Early Efforts With Videodisc

From its inception videodisc technology struck the pharmaceutical industry as a unique and highly visible educational/marketing tool. In fact, some of the very first videodisc productions were commissioned by pharmaceutical companies. In 1979 Roerig and Smith Kline & French each made the decision to develop videodisc-based exhibits to be shown at medical conferences and symposia. They knew that the "high tech" aura of the videodisc, along with its ability to provide random-access video images, was sure to capture the attention of their physician-based clientele. The response to these exhibits was outstanding, initiating what has become a multi-million dollar industry.

Roerig/Pfizer Laboratories

Roerig, a division of Pfizer Laboratories, developed their first videodisc, *Borderline Personality Disorders*, in time to be shown at the 1979 American Psychiatric Convention in New Orleans. The program was produced by a division of the advertising agency BBD&O in what was surely the fastest videodisc project of its time.

According to John Pace, then General Manager of the Health Education Technologies Division, the disc was "sold, scripted, shot, post-produced, mastered, and shown in a six-week period." In order to get that kind of turn-around in those days, Mr. Pace resorted to camping out on the DiscoVision doorstep in Costa Mesa for a week. He reports it was worth the effort, however, as the exhibit played for three days to sold out audiences and received rave reviews from the convention participants. Since then Roerig has sponsored at least three other videodisc programs: *Urodynamics in Clinical Practice*, *Nephrostolithotomy: The Percutaneous Route*, and *Challenges in Urology*, all three Level II productions.

Smith Kline & French

Smith Kline and French (SKF) International entered the videodisc market with the disc *Diagnostic Challenges in Gastroenterology*. The program was produced by WICAT Systems, Inc. in 1979 as an exhibit for an upcoming gastroenterology congress in Hamburg, Germany. At the time it was not conceived as an on-going project, but the success of the exhibit led to the evolution of a gastroenterology series.

The series consists of at least four videodiscs, including three patient management simulations. Each of the programs is approved for Continuing Medical Education (CME) credit. The videodiscs in the series are level III programs which run on a Pioneer 7820 videodisc player and a WICAT computer. The series is shown on 40 videodisc systems in 12 countries overseas but is not available in the U.S. The programs are used in a variety of ways, depending on the needs of each SKF subsidiary. One method common in Belgium and Italy is to leave the system in teaching hospitals for weeks or months so that they can be viewed by the hospital staff or used by physicians to teach medical students. Other countries, such as Spain, the United Kingdom, and Holland, prefer to circulate their systems among a variety of symposia, meetings, workshops, and conventions.

Miles Pharmaceuticals

In 1981 Miles Pharmaceuticals became the first to invest heavily in videodisc hardware systems for distribution. They did it in the form of the Miles Learning Center--a stand-alone system consisting of a Pioneer PR-7820 videodisc player and a Sony 19" color monitor. Today, some 275 of these systems are located in major teaching hospitals across the country as the result of an educational grant from Miles.

The idea for the Miles Learning Center came from the medical advertising agency of Medicus Intercon, which also handles most of the day-to-day activities of the project. According to Miles representative William Isbell, Miles' goal in setting up the system was to establish an image for themselves in the hospital environment. They felt they could achieve this by providing hardware systems to the hospitals along with videodiscs on a wide variety of medical topics of interest to Miles. However, unlike other pharmaceutically-sponsored videodiscs, Miles decided not to include product information on the discs they distributed. (Before this decision was made, however, Miles did produce an early disc titled *Mezlin Case Studies* based on a Miles antibiotic.)

Many of the first Miles discs were simply conversions of existing film and videotape programs to videodisc, with basic interactive features added such as menus and multiple-choice quizzes with remedial branching. The first disc to be designed exclusively for Miles was an orientation to the Miles Learning System, produced by Fusion Media. Since then the Miles library has expanded to more than 20 titles and continues to grow.

Merck Sharp & Dohme International

About the same time Miles was distributing their first discs, Merck, Sharp & Dohme International (MSDI) also began using videodisc technology as a marketing tool. They commissioned Romulus Productions to produce *The Challenges of Glaucoma*, a program which provided information on the diagnosis and treatment of glaucoma. MSDI was interested in using the videodisc to display information at medical conventions and profes-

sional meetings. According to Romulus President Peter Crown, the requirements for the exhibit were that it "attract the viewer's attention, appeal to the high-tech interests of the audience, and be able to hold the interest of those with even a short attention span."

The system that was developed for the disc consisted of a Pioneer PR-7820 videodisc player, Apple II + computer, and Sony 19-inch color monitor. Because the program was to be used as an exhibit, it was installed in a display cabinet and programmed with an "opening video loop" which cycled an introduction until someone began using the system.

MSDI has since moved to touch-screen technology with graphic overlay capability and is using Sony videodisc players. According to Mike Noar of MSDI, they have developed more than a dozen interactive programs for use at conventions, professional meetings, and seminars. The response to these programs has been so good that MSDI has had numerous requests for them from physicians and medical clinics. In turn, MSDI is becoming increasingly confident in the videodisc as a marketing tool and plans to continue developing programs for the next several years.

Winthrop Pharmaceuticals

Winthrop Pharmaceuticals (formerly Winthrop-Breon), a division of Sterling Drug, Inc., was the next pharmaceutical company to make a strong commitment to videodisc technology. Winthrop videodiscs made their first convention showing at the 1982 American Hospital Association meeting, where they presented both their Consult Series, which is free of product promotion, and their Video Clinic Series, in which they teach the use of their products. The original exhibit could seat up to eight participants. However, the response to the exhibit was so good that subsequently they built a second booth to accommodate 20 stations and run four programs simultaneously.

Soon after their exhibit success, Winthrop made the decision to expand their videodisc program and take it into the field. An initial investment was made in the neighborhood of \$750,000 to purchase over 100 videodisc systems. These systems were then put into the hands of Winthrop-Breon's hospital representatives who loan them for short periods to various hospital departments.

Every time a Winthrop program is viewed, whether at a conference or in a hospital, the user's scores are stored in the computer's memory. This enables Winthrop to see how many people are using the programs and at which locations. This information is used, in part, to monitor the cost-effectiveness of the program. In 1985 the hospital systems were averaging about six participants a day, a figure that Winthrop representatives feel is well worth the investment.

Profile of the Field Today

Today, a large number of pharmaceutical companies are using videodisc technology for exhibits, continuing education, and sales training. What these companies are finding is that, with the increased use of videodisc for exhibits, audiences are becoming more sophisticated and now have higher expectations regarding the programs they view. The videodisc alone will no longer elicit the desired audience response, and leaders in the field are already looking to incorporate new technological advancements and innovative design strategies. "The videodisc is a wonderful technology...but you've got to have other

things to go along with it," reports one manager who has been developing videodisc programs since 1981. Another experienced manager agrees, saying that "inevitably, the disc will become just one component of a larger system--just as the computer has." The "other things" they are talking about include high-resolution graphics, digitized audio, and sophisticated input devices such as voice and image recognition.

This trend is evident in the changing ratio of Level II productions to Level III productions over the past few years. In 1984 half of the pharmaceutical videodiscs produced were Level II productions. Of the discs produced since 1985, only 30 percent were Level II, with the number dropping to only 20 percent when looking at only those produced in 1986.

The Role of the Developer

It is likely that the number of pharmaceutical videodiscs produced each year has doubled from the 1986 figures—to a \$12-\$14 million market in 1988 or 1989. Videodisc developers who stand to benefit most from this growth are those who position themselves early and who have experience dealing with the pharmaceutical industry. Not surprisingly, those developers already entrenched in the pharmaceutical marketplace are preparing to meet the challenge of new developers. At this point, however, the evidence suggests that many opportunities still exist within the market for qualified vendors. Conversations with marketing and product managers provides some insight into what pharmaceutical companies are looking for in a videodisc supplier.

Qualifications

Above all other considerations, managers expressed a concern over the supplier's knowledge of the pharmaceutical industry as a whole--and their marketing needs in particular. One manager complained that he has "guys coming in here trying to sell us things the same way they sell to the automobile industry or the meat packing industry." Perhaps the mood is best captured by the comments of one manager in particular who says:

"A lot of people call and tell me that they do symposia, interactive video, all kinds of CME programs, and what have you. The way to get business here is if you learn about our products and come by with an idea that you think you can sell to a product director. If you're going to concentrate in the pharmaceutical industry, then you have a responsibility to learn something about it. If you don't know all about the industry, if you don't know the products, if you don't know the areas of therapy, then you've got to team up with people who do."

Approaching Pharmaceutical Companies

When asked for their feeling about "cold calls" by vendors, managers replied with comments such as "you won't get to see me without a specific idea" and "my secretary screens things well enough that I don't have to worry about dealing with unprepared suppliers." Most managers feel that vendors should "do their homework" before approaching them with a proposal. "I'm not going to tell suppliers how their services can meet my needs," says one product manager. "They should know my product line...and a good deal more." Another manager concurs, saying that many vendors approach him with

what he calls a "blunderbuss approach...that interactive video can do this, this and this, but they usually need to be furnished with information about where it meshes with our particular needs."

Only one manager showed signs of compassion toward the uninformed supplier, saying "In all fairness to vendors, I don't know that they have much choice. It would not be possible, at least where I'm concerned, for them to know enough--to have enough inside information on a market strategy, disease group, and so on--to propose something tailored to our needs."

This attitude, however, is the exception rather than the rule. As another manager points out, "You can get access to everything we do here--it's available to anyone willing to look for it." Suggestions regarding the ways in which suppliers can learn about a particular company include studying the annual report, journal advertising, promotional publications, and even talking to physicians who deal with pharmaceutical representatives. Other suggestions include tapping the audits to "see what our promotional spend levels are and how we spent it," and attending medical trade shows to see what is being done with interactive video in any particular product area.

Summary and Conclusion

Over the next few years the pharmaceutical industry will continue their leadership role in producing medical videodiscs. What was a six-to seven-million-dollar-a-year industry in 1986 is likely to be twice that today. Thus far, most programs have been used as medical exhibits. However, strong growth is taking place in the use of videodisc programs for sales training programs. In addition, with the slow but inevitable accumulation of videodisc hardware systems in the healthcare schools and clinical settings, look for an increase in the number of videodiscs developed by pharmaceutical companies for distribution as continuing medical education programs and product information programs.

Vendors looking to enter this market should have a familiarity with the pharmaceutical industry as a whole and a detailed knowledge of their client's products and marketing needs in particular. To keep pace with the viewing audience's increasing level of sophistication, vendors must also be willing to incorporate innovative instructional design strategies into programs that make use of the latest in videodisc technology.

Overall, the videodisc has proven itself to be a tremendously successful marketing tool that has just begun to show its potential. Pharmaceutical companies are certain to increase their use of the videodisc and related technologies for educational, promotional, and training purposes--especially as the videodisc industry begins to solidify and establish some much-needed standards. Concurrently, prospects are good for videodisc suppliers who are qualified to meet the stringent demands of the pharmaceutical managers.

Active Pharmaceutical Companies

Ayerst Laboratories

Ayerst's first videodisc project was the Ayerst Heart Study Center, produced in 1984 by Daniel J. Edelman, Inc. The disc is part of a larger, interactive museum exhibit that promotes information about heart disease and treatment, including drug therapy. Ayerst

also has produced at least two Level II videodiscs (cardiology and endocrinology) through their marketing department. These discs were distributed to hospitals and medical schools that have the Miles Learning Center (Pioneer 7820 videodisc player).

Burroughs-Wellcome Co.

Burroughs-Wellcome has produced at least one videodisc in 1985 titled *Herpes Infections: Diagnosis and Management*. Designed for use at medical conventions, the disc provides physicians with current methods for diagnosis, treatment, and counselling of patients with genital herpes.

Cook-Waitt Laboratories

Cook-Waitt sponsored an interactive videodisc program in 1984 called *Periodontal Perspective on Synthetic Bone Implants*. The program was used as an exhibit until 1985 when Cook-Waitt discontinued their sales force in favor of telemarketing. Cook-Waitt will not be doing any more videodiscs and have turned their equipment over to their sister company, Winthrop-Breon.

Galaxo Inc.

Galaxo recently produced a Level III interactive videodisc program to train their sales force. Design and production was done by Learning Resources Network in Durham, North Carolina.

ICI Pharma

A newly-formed company, ICI Pharma developed an Interactive Office, an exhibit with mannequins so realistically crafted that a lot of doctors mistake them for living patients. At each carrel, a physician sits across the desk from the "patient" and conducts an interactive case study. Graphics, text, and diagnostic images are displayed on the monitor via videodisc. The exhibit features four case studies that are delivered using holophonic, or 3-D sound.

Eli Lilly & Company

Lilly has produced at least two videodisc games, *Medical Trivia* and *Pharmaceutical Trivia*. Both are used as exhibits. *Medical Trivia* was conceived during 1984 when one of the product managers began putting together medical trivia cards for the Trivial Pursuit game. Eventually, it was developed as an interactive exhibit that is non-product oriented and can be adapted to different medical specialties. In 1986 a pharmacy version was completed.

McNeil Pharmaceutical

McNeil has produced at least three videodiscs: *Diagnostic Treatment Decisions in Acute and Chronic Psychotic Disorders*, *Case Studies in Diagnosis and Treatment of Psychiatric and Geriatric Disorders*, and *Calcium Antagonists*. The first two have been distributed to hospitals and medical schools that have the Miles Learning System (Pioneer 7820 videodisc player).

Mead Johnson & Company

Mead Johnson produced a sales training videodisc program based on a national session for a product introduction held in 1983. It is their first and only videodisc, although they have produced a number of videotape programs.

Merck Sharp & Dohme International

Merck Sharp & Dohme International's (MSDI) first videodisc project, *The Challenges of Glaucoma*, was produced in 1981. Since then, they have developed more than a dozen interactive programs--some videodisc, some graphics only--for a Level III touch-screen system. These programs are used primarily at medical meetings, seminars, and symposia.

Miles Pharmaceuticals

Approximately 350 Pioneer 7820's and at least 18 different videodisc programs were donated to hospitals and medical schools by Miles Pharmaceuticals between 1981 and 1985 as part of an image-building campaign. The videodiscs produced for the system included a nine-part series on Nosocomial Infections. This series of videodiscs was designed as Level III programs to be used at major medical conventions, with Level II versions of the discs being produced and distributed to the Learning Centers.

Pfizer International

Pfizer International is using a training tool that uses videodisc to improve selling skills of its sales force. Called Simulation System Trainer, or SST, this new device allows a sales representative to interact with a videotaped actor (on videodisc) posing as a physician in a simulated sales call. The sales representative in training responds to the physician's questions about a drug, with the sales rep's responses videotaped by a camera mounted on the computer. Using a hardware configuration developed by Performax, Inc., the SST produces a videotape of the entire interaction between the sales representative and the physician. The sales representative and his or her trainer or supervisor then can review and critique the videotaped performance.

Roche Laboratories

Roche has produced at least two videodisc patient simulations which use an interactive manikin. "Peter" and "Morton" are both used to instruct physicians in methods for arriving at a sound diagnosis and treatment regime based on a specific case study.

Roerig

Roerig has produced at least five videodisc programs since 1979, with each being used as an exhibit. The first videodisc, *Borderline Personality Disorders*, was developed in time to be shown at the 1979 American Psychiatric Convention. Since then, Roerig has sponsored *Urodynamics in Clinical Practice*, *Nephrostolithotomy: The Percutaneous Route*, *Challenges in Urology*, and *Beta Lactamase Inhibition*.

Sandoz Pharmaceuticals

Sandoz has produced at least four videodiscs, all used as exhibits. Subjects include Alzheimer's Disease, Deep Pain Thrombosis and Pulmonary Embolism (for product EMBOLEX), and Parkinson's Disease.

Smith Kline & French Laboratories (USA)

Smith Kline & French (SK&F) was among the first to produce videodisc programs in 1979 with the series *Diagnostic Challenges in Gastroenterology*. At least 12 discs were produced since then—two in gastroenterology, eight in infectious diseases, and two on rheumatology.

Smith Kline & French International

Smith Kline & French International (SK&FI) developed its first videodisc in 1979 for the gastroenterology series. Since then they have completed at least four videodiscs in the series. The discs are used overseas on 40 videodisc systems in 12 countries. The systems are used as exhibits in addition to being loaned to hospitals and medical schools.

Stuart Pharmaceuticals

Stuart has produced at least five videodiscs, including the series *The Challenge of Series Infection*, designed to be used at major medical symposia and scientific meetings. They have also completed work on a companion series, *The Challenge of Antibiotic Therapy*. In addition to the videodisc programs, Stuart also is producing Continuing Medical Education (CME) accredited videotape and workbook versions of the programs that will be distributed by their sales force.

Syntex Laboratories, Inc.

Syntex completed their first interactive videodisc, *Prostaglandins and the Gastrointestinal Tract*, in 1985. It is used as an exhibit to introduce physicians to prostaglandins as a new form of treatment for duodenal ulcers and other gastrointestinal disorders.

The Upjohn Company

Upjohn has produced at least four Level II videodiscs which are used as exhibits and were distributed to hospitals and medical schools that have the Miles Learning Center (Pioneer 7820) videodisc player. A Level III program on the locus ceruleus of the brain was recently produced and is used as an exhibit only. The two Level II programs *The Brain and Anxiety*, and *Hypnotic Selection: A Censuses Update*, is at least a second-generation videodisc, the first versions being done in 1983.

Winthrop Pharmaceuticals

Winthrop has produced a series of at least seven videodisc programs that play on a proprietary delivery system and has recently ported them over to run on the Sony VIEW system. Topics include analgesics, anesthetics, cardiology, gynecology, and radiology. All are approved for CME credit. Sales representatives take the systems into hospitals and leave them for short periods of time. The programs are also used as exhibits.

Chapter 3

Universities/Colleges

Universities and Colleges have been drawn to the incredible potential of the videodisc as a teaching tool and image storage medium. So far, these institutions have played an important role in the research and development of interactive videodisc programs. Undermanned and underfunded, health sciences schools have, over the years, developed the prototypes which serve as the inspiration for many of the commercial products now being developed. Now the school environment is beginning to produce enough videodisc courseware of their own to make up about half of the health-related videodisc courseware available for purchase.

Early Videodisc Efforts

Looking at the early years of health-related videodisc development, two universities stand out as pioneers in the field: the University of Iowa and the University of Washington. The University of Iowa, through the Weeg Computing Center, produced two programs in 1982, both using the now discontinued Thomson-CSF transmissive videodisc player. *Urology Retrieval* was a pilot project to demonstrate the advantages in ease, speed, and accuracy of retrieval of visual images from videodisc. *Gynecology Patient Education* was the first patient education videodisc ever developed and contains information on radiation therapy for cervical cancer. Although neither of these discs is available today, the University of Iowa has produced several other programs for distribution, including *Assessment of Neuromotor Dysfunction* and *Lamaze: The Nurse's Role*.

The University of Washington, through the Health Sciences Learning Resource Center, produced several videodiscs in 1982, many of them for the Miles Learning Center (see Chapter 2, *Pharmaceutical Companies*). The most popular of the early discs was the *Medical Applications Videodisc: Hematology*, also known as the Hematology Disc. This disc contains more than 6000 slides and several films, and was responsible for the term "generic videodisc." Generic videodiscs are those that contain slide collections, sometimes film footage, and are programmed for instruction by the institution that purchases it. Other early videodiscs produced at the University of Washington include *Trauma Training Materials*, *Clinical Microscopy*, and *Acute Leukemia Morphology*. In recent years, the University of Washington has produced seven other generic videodiscs, all of which are available for purchase.

Distributing School-produced Programs

As more and more educational institutions are becoming involved in the development of generic videodiscs and interactive videodisc programs, they are looking at ways to make their courseware available to other schools and at the same time recover some of the development costs of these programs. They are finding, however, that they lack the experience, and often the administrative flexibility, to do so easily.

Co-ventures With Medical Publishers

At the same time, commercial companies are looking to "pick up" existing programs to distribute, thereby saving the significant expense of developing their own programs. Schools with reasonably good, marketable programs can expect to be approached by a half-dozen commercial firms who would like to market their programs for them. Such an arrangement was established early between the University of Iowa and medical publishers Williams and Wilkins in Baltimore, Maryland. After having produced *Assessment of Neuro-motor Dysfunction in Infants* in 1984, the University of Iowa agreed to allow Williams and Wilkins to market the program. Another cooperative venture was *Sight Through Sound: An Interactive Introduction to Medical Diagnostic Ultrasound* produced in 1984 by another medical publisher, W.B. Saunders Company. Although the entire project was funded by Saunders, the disc was produced in cooperation with the Thomas Jefferson University Hospital, with all scenes being shot on location there.

These publishing firms found, however, that there is a multitude of problems associated with marketing videodisc courseware. Not the least of these is the lack of an established hardware base. Instead of purchasing just a \$1,000 videodisc program, many buyers find they are forced to spend an additional \$6,000 to \$10,000 on a hardware system to play the program. Another problem until recently was the lack of hardware standards. Even if a school found the money to purchase the necessary hardware configuration, there were no assurances that other commercial videodisc programs would be able to play on that same system. A third problem with selling videodisc courseware developed by health sciences schools is the limited market. Most of these programs cover specific topics which limit their usefulness to a potential market of hundreds, rather than thousands. This, combined with the less-than-commercial-quality production value of most programs, makes it difficult to sell enough programs to justify the cost of development, replication, packaging, marketing, and distribution.

Changing Market Conditions. In the past year, there has been an increased level of interest in interactive video among health sciences schools—a primary market for publishers. This fact, combined with a move toward hardware standardization, has led medical publishers to reassess the market.

Williams and Wilkins, looking to expand their computer-based electronic publishing offerings, had a one-year option on the rights to the *ElectricCadaver*, a *HyperCard* textbook of anatomical images and graphics developed at the Stanford University School of Medicine. However, they recently let this option expire.

Meanwhile, the University of Colorado Health Sciences has developed a three-dimensional atlas of the human knee with developmental funds provided by St. Louis-based publisher C.V. Mosby & Co. As of January 1990, Mosby has not made a decision whether to

market the disc alone, or to support the development of additional atlases covering other areas of human anatomy.

Other Commercial Co-ventures

Some commercial vendors who have developed their own courseware for the healthcare market find it is easier to market a large library of programs rather than a few programs. For this reason, many vendors are always looking to pick up and polish school-produced programs that they can add to their offerings.

Applied Interactive Technologies. One effort at a school/commercial co-venture involves a low-cost, proprietary, hardware delivery system. Applied Interactive Technologies (AIT) in Jackson, Mississippi put together a Level III hardware system that sells for only \$1500. Since this system is proprietary and not compatible with other integrated systems such as the IBM InfoWindow or the Sony View system, the AIT system can not play videodisc programs developed by anyone but AIT. Therefore, in order to sell the system, AIT put together a library of videodisc programs by contacting schools and commercial firms that already developed programs and received permission to convert these programs to the AIT system and market them.

The advantage of this arrangement is the low cost of the delivery system. The problem is that schools and hospitals who buy this system are limited to one developer for their supply of courseware. They would not be able to use any programs developed by other commercial firms and by other health sciences schools. This hardware/software package was introduced in February 1988 and has not been very successful.

ALIVE. Another firm that began picking up courseware developed by schools is the ALIVE Center, developers of the *Active Knee* series of videodisc programs. In order to broaden their courseware selection, they secured rights to *A Right to Die*, a videodisc program produced by Carnegie Mellon University. They also are marketing a two-disc interactive videodisc program *Preventative Cardiology*, produced in conjunction with the Case Western Reserve University's School of Medicine.

Edudisc. Edudisc, Inc., of Nashville, Tennessee develops and distributes interactive video products using the Macintosh computer. To add to their offerings, they picked up several programs developed by Bloomsburg University. The programs are *Introduction to Case Studies in Hematology*, *Child Sexual Abuse*, *Stress Management*, and *AIDS Education*.

Health Sciences Consortium. The Health Sciences Consortium is a non-profit cooperative created in 1971 to distribute health sciences instructional material. Recently, the HSC has been distributing several videodisc programs developed by schools who are members of the IBM-sponsored Healthcare Interactive Videodisc Consortium.

FITNE. The Fuld Institute for Technology in Nursing Education was organized by the Helene Fuld Health Trust to promote the use of technology in nursing education. One of the activities of FITNE is the development and distribution of interactive video courseware for schools of nursing. The first program developed by FITNE was originally produced at Hocking Technical College. FITNE is reviewing additional school-produced programs for additional development and distribution.

Stewart Publishing. Stewart Publishing, Inc., sponsor of the Interactive Healthcare Consortium, helps schools market their own material, or will market and distribute the pro-

gram for them. Stewart Publishing usually picks up programs which, although useful, have a limited sales potential and, therefore, do not justify the expensive marketing and promotion allotted programs with a wider distribution potential.

Schools as Marketing Agencies

More and more schools are acting as their own marketing and distribution agent for videodisc programs developed in-house. The first, and perhaps most successful, of these is the University of Washington (UW). UW has produced a total of 11 programs, most of them "generic," on topics covering trauma training, microscopy, hematology, and neurology. The price of these discs range from \$175 to \$300. These discs contain medical images and are not sold with any type of instructional programming. This is left to the purchaser to develop.

The UW has been successful selling these discs because 1) the discs themselves were of high production quality, 2) they were generic discs (images only, no programming) which prevents running into the "not invented here" syndrome, and 3) they kept their overhead low. Because the total sales of any one disc ranges between 100 and 300 copies, there isn't any margin for expensive marketing.

Most schools, however, have only one or two videodisc programs to offer, and realize that their program has a limited audience. Their marketing efforts usually are limited to word-of-mouth and occasional brochures. These schools, because of the low volume of sales, are able to handle the packaging, distribution, and product support themselves. One of the more successful schools in this category is the University of Utah, which has been selling the shared disc *Slice of Life*. Developed by the Pathology Department, in conjunction with Media Services, sales and distribution are handled by the health sciences library. Marketing assistance is provided by the Interactive Healthcare Consortium in return for a discount to members, and a portion of the sales goes to the library to cover their administrative costs.

Other schools who, in the past, have sold their own videodisc programs include the County College of Morris in Randolph, New Jersey, Simon Fraser University in Burnaby, Canada, University of Colorado Health Sciences Center, and the University of Georgia Department of Veterinary Medicine. Recently, many more schools are developing and selling their own programs, including Auburn University, British Columbia Institute of Technology, California State University-Chico, San Diego State University, University of Iowa, University of Maryland, University of South Alabama, University of Southern California, and University of Texas.

Videodisc Consortium

In 1987 five different resource sharing groups were formed, independently, to assist in the development and distribution of health-related videodisc courseware: the IBM-sponsored Healthcare Interactive Videodisc Consortium (HCIVC), Interactive Healthcare Consortium (formerly the MDR Videodisc Consortium), Fuld Institute for Technology in Nursing Education (FITNE), Medical Interactive Video Consortium (MIVC), and Consortium of North American Veterinary Interactive New Concept Education (CONVINCE).

Healthcare Interactive Videodisc Consortium (HCIVC)

In the fall of 1987, IBM helped 17 U.S. and Canadian medical and nursing schools form a self-governing organization to develop interactive videodisc courseware. Each member of the Healthcare Interactive Videodisc Consortium (HCIVC) is committed to produce five interactive videodisc instruction modules by mid-1990, for a total consortium library of 85 modules. Three IBM groups, Academic Information Systems (ACIS) in the U.S. and Canada, and MultiMedia Solutions (MMS), are providing financial and technical support.

The consortium meets twice a year to conduct organizational business and review each other's modules. Members use IBM's private computer network, InfoNet, to communicate with each other and with on-line IBM technical experts and trouble-shooters. IBM MultiMedia Solutions, in Atlanta, provides educational and technical support on the use of the InfoWindow systems and IBM's authoring systems.

Courseware Publication and Distribution. The Health Sciences Consortium (HSC), a non-profit publishing cooperative, has been chosen as the publisher for many of the HCIVC courseware. Anticipated prices for the programs are \$650 for HSC members and \$1,300 for nonmembers. Additional copies of any videodisc are expected to cost \$125 for HSC members and \$250 for nonmembers. HSC institutional membership is \$1,000 for one year, \$2,000 for three years, and \$5,000 lifetime.

Interactive Healthcare Consortium

The Interactive Healthcare Consortium (formerly the MDR Videodisc Consortium) was formed by Stewart Publishing at the request of individuals in health sciences schools, many of whom attended the general meeting of the Medical Interactive Video Consortium in October but were excluded from active membership because their fields of study were non-medical (nursing, dentistry, allied health, etc.) The IHC is an educational publishing cooperative dedicated to the development and distribution of interactive videodisc courseware in healthcare. Membership includes schools of medicine, nursing, dentistry, allied health, pharmacy, and public health as well as hospitals, professional organizations, and pharmaceutical companies.

IHC members are entitled to a number of benefits, including a free subscription to the *Interactive Healthcare Newsletter*, discounts of 10 to 20 percent on selected commercial videodisc programs, discounts of 15 percent or more on other commercial products such as videodisc players, hardware systems, authoring systems, and other design and development software, and 20 percent discount off all products and publications offered by Stewart Publishing. In addition, the IHC will assist in the marketing and distribution of interactive video courseware developed by member schools.

The IHC also organizes a shared videodisc entitled *Resources in Medical Education*, which contains material contributed by health sciences schools. *Resources* is used as a generic videodisc for repurposing by other health sciences schools and is updated periodically to allow additional contributions.

Membership in the IHC is \$300 per year, \$150 for schools of nursing and community colleges. As of January 1990, there were approximately 100 members in the United States and Canada.

Fuld Institute for Technology in Nursing Education

The Helene Fuld Health Trust is the largest private foundation in this country that directly supports nursing education. In the fall of 1987, the Trust established the Fuld Institute for Technology in Nursing Education (FITNE). FITNE is a separate entity from the Helene Fuld Health Trust and concentrates specifically on the use of technology in nursing education.

FITNE is a membership organization, with an institutional membership fee of \$300 per year and an individual membership fee of \$85 per year. Owned by the nursing community and designed to directly serve the technological needs of nursing education. It provides a clearinghouse for educational software and hardware through reviews and evaluation of software and hardware systems. Another aspect of the institute is to negotiate attractive pricing for members on software and hardware. FITNE's information dissemination system includes a newsletter, electronic bulletin board, and CAI development and application workshops.

Hardware Grants. Perhaps the most significant contribution by FITNE to date is the impact it is having on the placement of interactive video hardware systems in schools of nursing. In 1988, the Helene Fuld Health Trust, through the FITNE, selected 46 schools of nursing across the U.S. and Canada to become the first interactive video demonstration centers to receive InfoWindow-compatible FITNE interactive video systems.

The Institute's goal was to encourage commercial producers to devote more effort toward the production of instructional programs applicable to nursing education and to provide cost savings to FITNE members who purchase the hardware and software developed by the Institute. Two FITNE Interactive Video Systems were provided to schools with more than 100 full-time nursing students, and schools with less than 100 full-time students received one system. Schools also received a copy of the interactive video instructional program *Intravenous Therapy*, distributed by FITNE. All schools will participate in data collection and evaluation for three years.

The placement of these systems and others FITNE shipped during 1988 meant there were more than 100 identical pieces of hardware in over 60 schools by the end of the year. In addition, the Helene Fuld Health Trust will continue to make hardware grants to nursing schools each year, adding to the number of compatible interactive video systems placed in this market.

Medical Interactive Video Consortium

On June 24, 1987, a meeting was held in Bethesda, Maryland of individuals to discuss the possibility of forming a consortium to promote and engage in production of interactive video materials for physician training. Present were representatives from 13 medical schools, the US Army, the US Navy, and the National Library of Medicine. It was unanimously agreed to form such a consortium, and a steering committee was elected. The thrust of the consortium is to 1) share resources in the production and dissemination of interactive video materials (discs, software, etc.), 2) promote standardization of hardware and software, 3) act as a source of information about interactive video in medical education, 4) be a source of information about current and proposed interactive video productions (to reduce duplication of effort), and 5) to undertake volume procurement of interactive video materials. It was decided that membership in the consortium would be open to

all universities and governmental agencies engaged in education of medical students or physicians. There will also be individual memberships for those attached to such institutions. The MIVC has a membership meeting in November of each year in conjunction with the Symposium on Computer Applications in Medical Care (SCAMC) meeting.

CONVINCE

CONVINCE (Consortium of North American Veterinary Interactive New Concept Education) is a not-for-profit organization allied with the American Veterinary Medical Association. The primary purpose of CONVINCE is to encourage cooperative development and sharing of interactive video and hypermedia programs for veterinary medical education.

CONVINCE was formed in 1987. Its formation was catalyzed by the 9th Symposium on Veterinary Medical Education which emphasized the need to alter veterinary medical education through increased fostering of problem solving, independent study, and the adoption of modern technology. Interactive video and hypermedia are powerful educational delivery systems which couple video and the computer into a single interactive learning tool.

CONVINCE is dedicated to implementing change in veterinary medical education by encouraging the following: involvement of American Colleges of Veterinary Medicine and allied groups in collaborative efforts to incorporate interactive video and hypermedia into educational programs; excellence in program development; hardware and software standards to assure that materials which are developed can be shared; coordination of program development to minimize duplication of effort; and development of evaluation systems that will help universities recognize and reward faculty for scholarly program development.

Active Schools and Colleges

Auburn University

The College of Veterinary Medicine was instrumental in forming a consortium for the development of videodisc-based instructional materials. A prototype disc on heart sounds has been completed, and other discs are in the planning stages. Funding is provided by the Geraldine R. Dodge Foundation and the Merck Company Foundation.

Cardiovascular Laboratory Videodisc Simulation. The college also has created an interactive video program entitled *Cardiovascular Laboratory Videodisc Simulation*, a collection of lessons which simulate cardiovascular physiology experiments traditionally conducted by health science students. *Cardiovascular Lab* is the first of a series of planned videodisc lessons including *Heart Sounds*, *Hemorrhagic Shock and Transfusion*, and *Respiratory Mechanics/Gas Exchange*.

Cardiovascular Lab Simulation includes chapters on the following topics: Introduction and Instructions, Experimental Preparation and Instrumentation, Cardiac Catheterization, Autonomic Control, Positive Pressure Ventilation, Manometer Experiments, Fibrillation, Termination, Cardiac Cycle, and Abnormal Cardiac Cycle, Autonomic Tutorial.

Drug Use Guide. Working with Auburn University's School of Pharmacy, the US Pharmacopeia (USP) has developed an electronic version of its definitive reference of drug information, *USP Dispensing Information (USP DI)*. USP has licensed a CD-ROM product and has developed four Level Three interactive prototypes to dispense information to patients wherever they are counselled — at pharmacy counters, clinics, hospital and nursing home pharmacies, physician's offices, HMOs, and ultimately by general public access.

The interactive video program, *USP DI Visualized*, presents specific health and drug information found in *USP DI*, such as the proper techniques for self administration of medications, possible side effects, and adverse reactions. The system also provides a health check feature, tailors prescription according to inputted patient information, and tests the user on his/her knowledge of the information presented through the program.

Bloomsburg University

A Center for Instructional Systems Development was established at Bloomsburg University in Pennsylvania—thanks to funding by the Ben Franklin Advanced Technology Partnership. The purpose of the center is threefold: 1) to support the design and development of computer-based interactive videodisc courseware for interested Bloomsburg University faculty, 2) to serve as a vehicle for partnership by seeking and supporting interactive videodisc projects for private sector entities through grants and sponsorships, and 3) to coordinate and cooperate with the College of Graduate Studies and Extended Programs in supporting human resource development in the Instructional Technology Master's Degree Program and Extended Educational Programs for corporate business sector training.

The initial award of \$66,131 was for the university to work cooperatively with the Geisinger Medical Management Corporation to develop model courseware for the training and retraining of nurses and physicians in critical care medicine. The following projects were completed:

Use of M.A.S.T. was developed using the Department of Transportation's objectives for pre-hospital personnel. The lesson is divided into eleven sections dealing with a different aspect of the M.A.S.T. The lesson has been tested with fifteen paramedics and EMT's.

Crisis Management of the Ventilated Patient consists of six simulated cases that give the nurses "hands-on" experience in the care of mechanically ventilated patients. Each case deals with a potentially life-threatening problem which these types of patients are especially prone to. The lesson is menu-driven and has extensive help options that allow the user to interrupt the lesson at any time for additional information.

Poison Prevention is a lesson developed in cooperation with the Geisinger Poison Center. The lesson was developed for five to seven year old children and is currently being used by the Poison Center staff for visiting school groups.

AIDS Education is an interactive video lesson for rural students between the ages of eleven and fourteen years old. The program presents information about the Acquired Immune Deficiency Syndrome. The information is necessary as the students are expected to change or avoid behaviors which spread the AIDS virus. The videodisc was designed not only to provide facts on AIDS and how it is spread, but also to stimulate active student participation in the decision-making process. Realistic scenarios provide students

with the opportunity to practice making difficult decisions that they someday may face in their own personal relationships.

Nurse Triage in the Emergency Room is a lesson that will provide students guidance and practice in the placing patients from an emergency room environment into the treatment categories. Proper placement will insure that treatment and medical diagnosis can take place in a timely and efficient manner.

Procedures in Critical Care is a companion disc to *Crisis Management of the Ventilated Patient*. This disc illustrates nursing skills and procedures that are necessary for the care of the critically-ill patient. The student controls the rate of information delivery and practice. Feedback generated by the computer further reinforces the learning.

Boston University

The Boston University School of Medicine has created two videodisc programs being used with undergraduate medical students. *Visual Guide to Tissue and Organ Histology* is an experimental videodisc that allows students to use supporting visuals during independent study. The disc contains 500-600 slides commonly used for the undergraduate histology course. A Level III program has been written that allows the students to select samples from any of three main sections: 1) Tissue, 2) Organ, and 3) Identification. The identification section allows the student to practice identifying samples selected by the computer. The other sections include examples of different categories including a written description of the sample. A "quiz me" section is planned for the future where the student would be asked various question about each slide.

Liver Pathology was created by Visage, Inc. in Massachusetts as a demonstration disc for use with their hardware delivery system. Approximately 80 slides from the Boston University's pathology department were included with other material in exchange for a copy of the disc. The slides were provided by Dr. John Dittmer and focus on tumors and cirrhosis of the liver. A Level III program has been written to allow students to select slides for viewing.

Bowman Grey School of Medicine

In January 1988 Bowman Gray School of Medicine unveiled their first interactive videodisc teaching program at the Second International Wrist Arthroscopy Congress. The program on wrist arthroscopy was conceived by Dr. Gary Poehling, an orthopedic surgeon at the medical school and chairman of the arthroscopy congress.

The program presents 25 individual topics covering anatomy of the wrist, operating room setup and instruments, fundamentals of using an arthroscope, and the diagnosis and treatment of common wrist pathologies. Dr. Poehling estimates most users will spend from two to eight hours reviewing the program material depending on their previous experience with the wrist and with arthroscopy in general.

Dr. Poehling created the wrist arthroscopy videodisc with the assistance of Dr. Boyd Richards, an instructional specialist working in the school's Office of Educational Research and Services. With funds from a special research and development account, Dr. Poehling contracted with the Learning Resources Institute in Durham, North Carolina to produce the program according to the specifications he and Dr. Richards had developed. Most of the video material came from archives of tapes prepared by the school's Audiovi-

sual Department. The AV Department also contributed illustrations depicting the anatomy of the wrist and configuration for setting up the operating room equipment.

British Columbia Institute of Technology

The British Columbia Institute of Technology (BCIT) has produced two videodiscs, one in heart anatomy and physiology and the other in radiology. *A Test Disc on Medical Radiology* is a prototype project exploring the use of videodisc for projecting radiographs in the classroom. The disc explores the use of still-frame transfer technology as a way of using videodiscs in the classroom. X-rays were transferred to video still frame using a Sony Mavica, which writes video signals to a 1-1/4-inch diskette. Each disk stores up to 50 frames which were then transferred to videodisc. The images are then played back in the classroom using a Sony Superbright projector.

Anatomy and Physiology of the Heart is a thirty-minute videodisc filled with several short introductory clips, video of surgical procedures, autopsy, moving medical images such as ultrasound, magnetic resonance imaging, or nuclear medicine, and a wide variety of anatomical specimens. These images are blended together with extensive computer graphics and text to portray each topic through a number of presentations of varying depth and speed. The program is comprised of 25 modules which cover six major themes: Cardiac Basics, Anatomy of the Heart, Cardiac Cycle - Mechanical, Cardiac Cycle - Electrical, Regulation of Cardiac Output, and Common Cardiac Pathologies. While each of the six themes is treated with an introduction, each of the 25 topics is presented through five venues:

Overview. This video clip introduces the topic showing its relevance and scope. It serves as an advanced organizer and presents many of the images which will be studied in greater detail in other venues.

Presentation. This covers the actual material to be learned. There is interaction with the material through the touchscreen approximately every 20 seconds. Relevant animations, computer simulations, and still images (with graphic overlay) are used as required.

Exploration. While the presentation deals with "need to know" material, the exploration deals with "nice-to-know" information and provides additional examples or views of medical imaging to supplement the topic.

Summary. This is a one- or two-page precis of the key points in the presentation. Students particularly like the summary when preparing for examinations.

Test. While review questions are given throughout the presentation, the test section provides access to an extensive test-item bank dealing with the topic. Since questions are drawn at random and the distractors appear in scrambled order, a wide variety of multiple-choice, labelling, or matching questions may be seen.

Case Western Reserve University

The Case Western Reserve University School of Medicine completed a shared disc in 1983 simply titled *Sharedisc*. Production of the disc was cosponsored by the RPC Corporation, NCR Corporation, and Media Videotex. The disc was produced as part of a joint demonstration project involving the production of videodisc material for use in undergraduate medical education. Areas of specialization involve neurology (special emphasis on the visual system), histology, and renal biology. Some comparisons of lighting and

camera techniques were carried out and various types of original media were employed. The resulting disc and instructional programs have been used in small-group teaching modalities.

Preventive Cardiology. CWRU also has developed a two-disc interactive videodisc program *Preventative Cardiology*. Produced in conjunction with the ALIVE Center, the program consists of two parts. Part I, geared for pediatricians and physicians, is designed to familiarize doctors with the procedures for distributing cardiovascular disease prevention information throughout their communities. It includes early detection and early intervention strategies for detecting and controlling arteriosclerosis.

The programs are designed to assist physicians in their discussions with patients about sensitive issues such as diet, exercise, and the risks of cigarette smoking. Interactive videodisc allows the physician to learn and practice Strategic Interview Skills. Through evaluation of doctor-patient dialogs, the physician learns how to encourage healthy behavior in his patients.

Part II is intended for doctors, patients, and students (junior high school level and above). It provides an overview of the heart and its relationship to the circulatory system, and it examines cardiovascular disease and coronary heart disease. The introduction covers basic information on the heart, the circulatory system, and arteriosclerosis, while three lessons zero in on effective means of combating coronary artery disease: exercise, nutrition, and not smoking.

Surgical Management Information Project. Medical students and surgeons-in-training at Case Western Reserve University are benefiting from the use of a newly developed *HyperCard* program on surgical topics. Now, instead of having to go to numerous sources to look up information about a surgical procedure, students can sit down at a single workstation and find print and graphic information on physiology, pathology, and histology, as well as X-ray, and video sequences of the operation.

The *Surgical Management Information Project* was conceived by Joel A. Weinstein, MD as both a surgical reference and as a way to orient students to surgical procedures. The work station consists of a two-screen Macintosh system. When beginning, students first see a card which gives them some background information on the surgical procedure. At the same time, they have access to two buttons: one that gives them a video index to access the laserdisc, the other to take them to a text index. As students click through the text area, they browse through cards that provide text information.

The student may be reading about the small intestine and the text may say "the intestine consists of three different parts, the duodenum, the jejunum and the ileum." That, alone, doesn't put an image in the student's mind. But the student has the option to click on a graphic that shows the relationship of the different parts to each other and to other structures around them. When the students are done with the graphic, they simply click on another button and return to the text exactly where they left off reading so they don't lose their train of thought.

Students may also go to the video index, where the operation is divided into multiple segments. Unlike linear videotape, videodisc material can be randomly accessed. This allows students to select any segment of the video material for an immediate viewing. If students don't understand how a particular aspect of an operation was performed, they can click on a button and immediately that part of the operation is playing on the monitor.

Cornell University

Cornell University Medical College, in conjunction with a grant from the National Institute of Mental Health, produced a videodisc program titled *An Interactive Video Course on AIDS*. The program is recommended for use in an AIDS-related clinic and is designed to gather and disseminate psychological, medical, and therapeutic information from/to AIDS Antibody Blood Test recipients. The course is part of a three-armed study to determine the effectiveness of a program designed to counsel and educate people who undergo blood testing for AIDS virus antibodies. The program also collects information from its viewers to determine a baseline of knowledge on the viewer regarding the full spectrum about AIDS and the antibody test.

Interviewing Skills. Another program produced at Cornell is *An Interactive Video Program for Teaching Interviewing to Medical Students*. This is part of a Cornell Grant project to determine the usefulness of interactive video as an educational tool, specifically with teaching interviewing to medical students. The content shows segments of a physician/patient interview (staged) and asks the medical student to analyze each and respond to its appropriateness within their notion of what a patient interview should include, should not include, and the order in which information should be gathered.

Pathmac. The Department of Pathology at Cornell has developed a videodisc network called *Pathmac* designed allow first and second year medical students access to a large mass of information. *Pathmac* is a Ethernet network of 20 Mac IIs. Each work station has a Panasonic player and a copy of the recordable disc, which contains approximately 4000-5000 images including gross and microscopic pictures of normal and pathologic specimens, microscopic sections (LM and EM) as well as a complete serial sectioning of the human brain with correlative CAT scans and MRI.

County College of Morris

The County College of Morris has developed a videodisc-based patient simulation for nurses, *Nursing Decisions: A Postoperative Patient*. The program allows the learner to exercise options, implement decisions, and follow up the results of those decisions free of the restraints imposed in most clinical teaching situations. By recording learner responses in computer memory, it also enables an instructor to review and evaluate the learner's performance in the simulation.

The videodisc depicts four postoperative situations and a client chart. Mrs. Morris, a postoperative cholecystectomy patient, presents symptoms common to many patients following abdominal surgery. Using the disc, the learner collects clinical data, analyzes the situation, makes decisions, and sees the results of those decisions depicted on the screen. Following the branching paths of the options presented, the learner actively applies and builds on his or her clinical knowledge to achieve a satisfactory outcome for Mrs. Morris. The four situations include: 1) a postoperative assessment on the day of surgery, 2) a focused oxygen assessment on the first postoperative day, 3) an intravenous therapy assessment on the third postoperative day, and 4) a health status assessment on the fourth postoperative day.

Florida State University

The Center for Educational Technology at Florida State University produced at least one videodisc program, *Human Genetics Training For Nurses*, in 1982 as part of the Children's Medical Services series. The program was designed to instruct nurses and associated health professionals in genetic diseases and disorders, as well as the nursing support role.

George Washington University

The George Washington University Medical Center has developed a videodisc entitled *Human Light Microscopic Anatomy*. Jointly produced with the National Library of Medicine, the eight-inch laser videodisc contains more than 2,800 human microanatomy images taken from microscopic slides.

The visual data base is paired with a computer data base/search program containing descriptive information about the images. The software allows the user to search for images using natural language or to change image descriptions, add or delete key search words, change hierarchical relationships of images, or create individualized slide shows. The program is designed to run on a two-screen PC videodisc configuration. The videodisc also supplements an anatomy text, *Introduction to Functional Histology* (by Ira Telford and Charles Bridgman), available from Harper and Row. The text has been laser barcoded so that users may drive their videodisc player with a barcode reader system.

Hocking Technical College

The Department of Nursing at Hocking Technical College has developed three interactive videodisc programs for nursing students. Each of the programs plays on a Level III system made up of a Pioneer videodisc player, IBM PC or compatible, VAL Microkey graphics overlay card, and a Sony PVM or Zenith monitor equipped with a Microtouch touchscreen.

Intravenous Therapy. This program is designed to teach clinical skills to nursing students. It contains six chapters: 1) IV Solutions, 2) Preparing Solution and Tubing, 3) Insertion of the IV Needle, 4) Maintaining the IV Solution, 5) Discontinuing the IV Solution, and 6) Complications of IV Therapy. The program includes some knowledge evaluations such as flow rates, order interpretation, and equipment identification.

Bedmaking. This program shows nursing students making an unoccupied bed. After each step the program pauses to give the student the opportunity to review the step or to continue with the lesson. The program is being used in the Interactive Skills Laboratory which contains seven workstations equipped with videodisc system and bed. The students use the disc while practicing. They can review elements such as mitered corners, and can stop the action, repeat, and review each step. Approximately 10 minutes running video.

Principles of Sterile Technique. This program has three parts: 1) A vocabulary section introduces the student to terminology, followed by a quiz. 2) A video segment illustrates ten principles of sterile technique. At the end of each principle the student has the opportunity to review or go on with the lesson. 3) Visual quiz. The student looks at a short vignette and has to decide what principle has been violated. If he answers incorrectly, he is given the chance to try again. If still wrong, the vignette is shown again. This

program is shown to students before teaching them procedures requiring sterile technique and takes the place of classroom lectures. It may also be used as remediation later if students have trouble performing procedures properly.

John Hopkins University

The Johns Hopkins University, in conjunction with the National Library of Medicine, has developed an interactive video tutorial for InfoWindow or compatible hardware systems. The content was developed by dermatology educators to emphasize the possibility of diagnosis of early melanoma by non-dermatologists.

The program was designed as a text-based tutorial on melanoma, with selected images from the videodisc used with graphic overlay. Authoring was performed using the IBM InfoWindows Presentation System (IWPS). Images of pigmented skin lesions were taken from clinical photographic slides and histologic sections loaned by William Crutcher, MD, and the University of Pennsylvania Pigmented Lesion Clinic. The American Academy of Dermatology also contributed to the production of the videodisc.

Leiden University (The Netherlands)

Professor H.A. Verbeek of Leiden University, in conjunction with an impressive team of advisors, specialists, and staff connected with VNU Nieuwe Media Groep and CAT BENELUX in the Netherlands, have produced a 30,000 image collection on videodisc for medical education. Included in the collection are drawings, photographs, micrographs, radiographs, and echocardiograms covering normal body systems and pathology, pediatrics, surgery, physical rehabilitation, and a wide range of other topics. An electronic index, searched using the "Freebase" data base program also comes with the collection.

Louisiana State University

The Louisiana State University Medical Center is creating a series of interactive videodisc modules to help medical students develop basic skills for conducting initial psychiatric interviews. Building on actual videotaped cases, the interactive videos bridge a gap between classroom instruction and real interviews on "rounds." One module teaches skills for active listening, directing an interview, gaining rapport, and observing non-verbal communication.

The Initial Psychiatric Interview is a set of interactive videos based on subject matter in actual case videotapes. Designed mainly for medical students, the series also has value for graduate education, social and pastoral care work, and other allied health fields. One module is already completed, one designed to teach skills in listening, directing and interview, gaining rapport, and observing non-verbal communication.

The decision was made to use an actual videotaped patient interview as a basis for content. The first task was to transcribe the videotape and prepare a rough script. Then a road map was charted, creating basic pathways for each of the four objectives: listening, rapport, interview technique, and non-verbal communication. The idea was to take the student down each path with motion video of the interview plus interactive questions and responses, and also to offer the complete, uninterrupted interview for review and voice-over commentary.

Once the motion video was shot, the team finished editing the video and audio tracks and integrated all introductory, how-to, graphics, and commentary material. Also added were a HELP function, a CONTINUE function to skip the introduction, a glossary of terms, and provision for a student ID number. The module was produced at an estimated cost of more than \$50,000, plus the time of the subject matter expert, Dr. Paul Ware.

Loyola University (Chicago)

The Stritch School of Medicine at Loyola University in Chicago recently produced a videodisc program titled *Pulmonary Procedures*. The program first presents the video of an actual procedure then interacts with the student to discuss the rationale of each step. Video segments and graphics are used to explain each step. Indications, preparations, complications, contraindications, and post procedure management are reviewed. A knowledge base is available for the student's review throughout the program.

McMaster University

Health Research Ontario, at the McMaster University, sponsored a videodisc program titled *The Way We Live* in 1984 to be used as a public health exhibit. An audience of up to fifteen faces one projection television screen and also sees two television monitors. The videodisc images appear on the projection screen, and graphs and text generated by computer appear on the two monitors. The audience chooses one of four characters as a surrogate and makes choices by pressing buttons marked "1, 2, 3." A computer branches the story according to the character chosen and other health-related choices made by the audience. The program was produced by Interactive Image Technologies Ltd. in Ontario.

Massachusetts Institute of Technology

In 1986, MIT was engaged in a campus-wide effort to integrate computers into all phases of the educational enterprise. One of the programs supported was a two-year effort to create a computer-aided learning system in neuroanatomy. Using conventional databases, videodisc, and CD-ROM, the program allows students to freely explore thousands of images of brain structure.

Most of the images that make up the instruction are computer-generated, three-dimensional views of the brain that allow the student to see any of a number of major brain structures and pathways, singly or in combination. These images are supplemented by video images of original slides and video sequences from a human brain dissection. The programmed instruction leads students through each of the neural pathways relevant to a particular function, presents a graphic display of the region, then asks questions and provides feedback to answers.

Medical College of Georgia

To better teach problem-solving skills to their medical students, Abdulla M. Abdulla, M.D. and John S. Henke, M.S. at the Medical College of Georgia (MCG) developed a series of videodisc-based patient simulations. The simulations allow the student to "interview" and "examine" a patient who presents a complaint or symptom.

As in other simulations, the student is required to diagnose and treat the patient by ordering diagnostic tests and therapeutic interventions. The unique aspect of this system is that it allows the student to enter questions and requests in plain English via the computer keyboard. The computer then compares the typed question with a list of synonyms and determines the appropriate response.

When presented with the question "Where does it hurt" or "Where is the pain located," the computer will key in on the words "where--hurt" or "where--pain", and might provide the user with a video sequence of the patient describing the pain in his chest. As the student progresses through the simulation, the computer is able to record a student's entries and compare his decisions with those established by a panel of experts. In this way, a score can be generated for each component, which includes history-taking, physical examination, laboratory evaluation, and therapy. The costs of diagnostic and therapeutic intervention are also tracked and compared with an expert's cost-of-care.

Some of the videodisc simulations completed to date include *Simulation of a Patient with Unstable Angina*, *Simulation of a Middle-Aged Man with Fever of Unknown Origin*, and *Simulation of an 11-Month-Old Child with Fever of Unknown Origin*. Each lesson was created on the MCG's PROF authoring system, which is written in machine language with the use of a "C" compiler.

Medical University of South Carolina

The Medical University of South Carolina (MUSC) produced the Introduction to Ultrasound videodisc being marketed by the American College of Radiology Institute. The program is designed primarily for medical students and radiology residents, and is widely used in the MUSC teaching program. The disc may be used as a Level III program for self-study, or can be shown during lectures to stimulate discussion.

Michigan State University

The Media Services Department and Pathology Department of Michigan State University are creating interactive videodisc instructional units on neuropathology topics for use by undergraduate medical students. These programs are being developed as *Hypercard* stacks with images from the *Slice of Life* videodisc, a shared disc coordinated by the University of Utah.

The first unit, *Central Nervous System Neoplasms*, consists of five parts: a pretest, an instructional lesson, a post-test based on information in the lesson, a clinical simulation emphasizing reinforcement of concepts and problem-solving related to neuroanatomy, neuropathology and neurology, and a glossary which can be accessed from the lesson or simulation. The instructional lesson includes an outline which provides random access to any topic in the lesson, didactic information taught in the neuropathology lectures, illustrations of pathology and radiology, questions to test understanding, and case histories.

During the clinical simulation (based on Neuropathology Problem Solving Exercises: Jones, et al., Soc. Neurosci. Abstr. 4:398, 1978) the student is given segments of the patient history followed by questions related to signs and symptoms. Then, autopsy neuropathological findings are presented, with questions related to the images of gross and microscopic lesions from the videodisc. For all questions, remediation or reinforcement is provided for each answer selected. Throughout both the lesson and simulation, glossary

entries are indicated by an asterisk following a word, and a mouse click will call up that entry. The CNS neoplasms unit underwent formative evaluation during summer and fall 1988, with additional units planned.

Preclinical HyperCard Stacks. Students in the College of Human Medicine at Michigan State University are developing extensive *HyperCard* stacks for use in Track II of the Preclinical Program. The Track II program is a problem-solving curriculum which is divided into 13 clinically oriented Focal Problems (e.g. Anemia, Mental Insufficiency, Muscle Weakness, etc.). Students are assigned required reading in each problem area and meet in small groups to discuss and integrate the information.

One Focal Problem group (12 students) organized the project which eventually involved 30 students. Each of the 12 students was assigned a discipline and became a "concept captain" for that discipline. Students were assigned required readings to summarize and organize information. This information was then entered into an Apple HyperCard program shell developed by several of the more computer literate members of the project. Students entered text, graphics and graphics—as well as sound and video images from a videodisc. The goal at this level was to identify and summarize critical concepts. Concept Captains had the goal of integrating the concepts at the discipline level. Finally, an Inter-Concept Linking Group integrated across disciplines. To date, two Focal Problems have been completed, the Anemia Focal Problem (called HYPER-ANEMIA) and the Jaundice Focal Problem. Each is being reviewed by faculty for possible inclusion in the Track II curriculum.

Northern Alberta Institute of Technology

The Health and Medical Science Departments of the Northern Alberta Institute of Technology (NAIT) are exploring the use of the interactive technologies as an alternate delivery method for regular daytime students and for continuing medical education. Two current projects include the development of a computer-managed course in medical terminology and the use of videodisc/computer combination to support medical terminology and basic medical science subjects.

NAIT has already purchased space on a University of Alberta videodisc and will use slides contributed by Medical Laboratory Technology instructional staff to create and pilot courseware in three areas: 1) classroom use of videodisc for lecture support, 2) the use of videodisc to instruct students in histological staining procedures and 3) using videodisc for a problem-solving simulation involving blood group matching in blood banking.

Ohio State University

The Office of Academic Services for Medical Education at the Ohio State University is developing a series of interactive videodisc programs on gross anatomy. The program series, entitled *Anatlab*, is designed to supplement the lab work in anatomy for the allied health professions. If successful, *Anatlab* will reduce the costs associated with the traditional anatomy courses by decreasing the number of teaching assistants and cadavers required for instruction.

To determine the effectiveness of *Anatlab*, half of the students in three gross anatomy classes were randomly assigned to either a computer lab or the traditional cadaver lab. The computer lab videodisc includes everything the students would see in the actual lab.

In addition, the interactive tutorial is written to simulate the kind of student-teacher conversations that usually occur during the three-hour lab covering the same material.

One week after the lab experience, each class was tested in an unannounced lab practical. Even though they were tested on the unfamiliar cadaver, in two of three classes, the students trained with the computer lab scored as well as the cadaver lab trained students.

Anatlab is the second videodisc produced by The Ohio State University College of Medicine and represents the combined efforts of several departments. The medical school's CAI center contains several hundred hours of programmed instruction, many incorporating videodisc still images, motion sequences, and sound. Student carrels are configured with IBM AT's, Sony or Pioneer videodisc players, and Sony video monitors.

San Diego State University

The San Diego State University School of Nursing has developed the videodisc program *The Story of Maria* to provide pregnant women with information on infant feeding. The Level III program was designed for use by Hispanic women and dramatizes the experience of a young first-time pregnant woman as she engages in the decision-making process regarding her choice of infant feeding. The user can follow Maria through the process of breast and bottle feeding and compare and contrast the two methods. Through the interactive component of the program, the user becomes actively involved in the issues faced by Maria, is able to internalize the information, and make informed choices about applying the knowledge to her own life. The program can be used in Spanish or English.

Simon Fraser University

The Department of Education at the Simon Fraser University developed *How Your Heart and Circulatory System Works* in 1982. The disc instructs children about the structure of the heart, function of blood, how to monitor heart rate and take blood pressure, and explains various diseases and disorders of the heart and blood vessels. A 110-page manual explains how to use the automatic and manual mode to arrange and locate materials. The manual also describes and lists locations of motion scenes, slide, and print material for each of the six chapters on the disc.

Stanford University

An electronic textbook developed by Stanford University Medical Center researchers could aid students trying to master the complexities of human anatomy. Combining text, computer graphics and full-color video, *The Electric Cadaver* allows a user to interactively explore the structure of the human body in a way unavailable in conventional printed books. The system displays images on two screens, one for computer graphics, the other for full-color video. A user can "jump" from picture to text to video and back, just as a reader jumps from place to place in a printed volume. *The Electric Cadaver* allows students to move beyond the lecture, printed page, and laboratory to the domain of interactive self-study.

David Bassett, M.D., a Professor of Anatomy at Stanford and the University of Washington, spent 15 years creating the anatomical images that form the core of *The Electric*

Cadaver's visual database. In collaboration with William Gruber, the inventor of the View-Master Stereo Slide System, Bassett worked through the 1940s and 1950s preparing 1600 pairs of stereo slides, originally published on ViewMaster reels in the *Stereo Atlas of Human Anatomy*. After Bassett's death in 1966, the collection fell into obscurity, despite their unique quality and comprehensiveness. Several years ago, at Dr. Robert Chase's urging, Bassett's wife, Lucile, reclaimed the original images and lent them to Stanford University. *The Electric Cadaver* will be released by medical publisher Williams and Wilkins for use on the Apple Macintosh computer sometime in 1990..

Syracuse University

The Psychological Research Disc was developed in 1985 by the Department of Psychology at Syracuse University to provide a tool to study the ability of subjects to mentally rotate abstract, two-dimensional figures. The program replaces paper and pencil measures.

Thomas Jefferson University

In March 1986, Jefferson Medical College published its first videodisc slide collection, *Resources in Medical Education-I*. The disc contains 1149 slides contributed by members of the Anatomy and Pathology Departments and fifteen minutes of video. The video segments include a tutorial on the integumentary system and a tutorial on range of motion. The slides also include illustrations from several anatomy textbooks, with the consent of their publishers. Because of its experimental nature and because of copyright restriction, the videodisc may not be sold to outside institutions.

In October 1987 the MDR Shared Disc *Resources in Medical Education-II* was released. This disc was the result of a collaborative effort by Jefferson Medical College, University of Florida, University of Cincinnati, University of Washington, and Duke University. The disc contains medical images covering microanatomy, histology, radiology, immunology, pathology, and clinical microscopy. Since then, a third edition of the disc has been produced and several tutorials have been developed using images from the disc. These include *CAI-IV Histology*, *Histology: Hematology*, and *Skin*.

Radiographic Artifacts Tutorial. The Thomas Jefferson University Office of Academic Computing, supported in part by the IBM Corporation, has developed an interactive videodisc program titled *Recognizing Radiographic Artifacts*. Developed for the IBM InfoWindow hardware system, the program is aimed at students of radiologic technology who must be able to distinguish artifact from pathology on an X-ray film.

The program consists of four modules: a tutorial on radiographic artifacts (objectionable features on an X-ray image that are not produced by the patient's body or pathology), a side-by-side comparison of artifacts and pathologies, image database, and a self-assessment exam. In the tutorial module, a radiographic image is displayed on the screen along with identifying information. Through the use of the touch-screen the user can ask for help in locating an artifact, identifying the cause of an artifact, or can ask for additional information in the form of explanatory text, graphics, or photographs. Examples of each of the major types of artifacts are presented, including patient belongings, ingested materials, hospital paraphernalia, and processing errors.

In the second module, artifacts with similar appearance are compared to one another and to the radiographic appearance of pathological processes. For this section, composite images showing side-by-side comparisons of two or more processes were created photographically before transfer to the videodisc. Distinguishing elements are highlighted and explained.

Administering Therapeutic Agents. Thomas Jefferson University also has developed an interactive videodisc learning package to assist nurses and other health care professionals in acquiring the knowledge base and psychomotor skills necessary to safely and effectively administer therapeutic agents to clients. This program facilitates decision making related to the total process of medication administration.

Tufts University

Tufts University School of Medicine is developing a series of interactive videodisc programs to help students understand the central nervous system. The initial five modules of the series are being produced at a total cost of about \$300,000. The modules progressively examine the CNS from the spinal cord through the brain stem and into the fore-brain. The first completed module is *Pathways in the Spinal Cord*.

The human brain model was created by assembling images of successive slices of brain tissue through the entire brain, which were then recorded on film. Each slice was optically scanned to convert its image to digitized data that could be read by computer. Finally, the data set was reconstructed and recorded three-dimensional animations of the brain on videodisc. It took a week, working twelve hours a day, to digitize a single series in one plane through the brain. A programmable video recorder taped the model rotating 360-degrees at different angles, and it took eight hours to record each angle during its full rotation.

After completing the first five fundamental units, which together depict the conscious sensory and voluntary movement systems, the team will develop additional units covering functions of cranial nerve nuclei and their control; the extrapyramidal systems and the control of movement; modulators of sensory function/pain; reticular formation and the limbic system; development of the nervous system; and stroke: language, memory, movement.

University of Alberta

In January 1984 the Instructional Systems Group of the Department of Computing Services at the University of Alberta decided to produce a videodisc for use with the University's PLATO system. The content of the disc included all the AV materials which had been previously delivered with random access cassette or microfiche on the PLATO CAL system.

University of California-Davis

The University of California-Davis, in conjunction with the University of Colorado, has developed an interactive video program for teaching sophisticated life-supporting procedures for hospital emergency departments. The program, *Computer-based Teaching and Evaluation of Thoracotomy Skills*, recently received an award at the American College of Emergency Physicians meeting in Washington, DC.

The course is designed to allow medical students and resident physicians to acquire and refine skills by observing and practicing simulated procedures. "The conditions we create put the student physician in a virtual hands-on environment," say Dane Chapman, Assistant Professor of Emergency Medicine and Clinical Toxicology at the University of California, Davis. "It presents the user with branching alternative or choices that must be made as the procedure is performed.

A sense of realism was achieved by videotaping actual surgical procedures. After an opening scene is created with sound and video of a simulated human patient, closeup surgery is performed on a pig, whose organs are very similar in function and appearance to human organs. *Thoracotomy Skills* provides the user with experience in a critical area of emergency care that is infrequently encountered in an emergency department. It also provides a means of evaluating a physician's procedural skills. The program was developed through support from the Emergency Medicine Foundation, the University of Colorado School, and the IBM-sponsored Health Sciences Interactive Video Consortium.

University of Cincinnati

The Computer-based Instructional Systems Department at the University of Cincinnati is developing a series of interactive videodiscs to teach undergraduate nursing students the skills needed to work with diabetic patients. *Balancing for Diabetic Control* presents two case studies via videodisc, with the primary case concerning an adolescent patient. Decisions are required by the student regarding the hyper- or hypoglycemic status of the patient. Various adolescent concerns (such as alcohol, drugs, and exercise) can be explored through the use of the videodisc by viewing actual outcomes of selected behaviors.

Health Assessment of the Diabetic Patient allows students to practice interviewing skills. Various slides illustrate the possible abnormalities that can be seen during the physical examination and are often contrasted with normal findings. Although based on one patient situation, the program can be used as a Level II disc to illustrate abnormal findings possible with diabetic patients.

Labor and Delivery. The College of Nursing and Health at the University of Cincinnati has developed a videodisc simulation designed to bridge the gap between classroom and clinical experiences in labor and delivery. The opening sequence of the simulation immediately immerses student nurses in a drama they may face as professionals: a birth is imminent, but other doctors and nurses are tied-up with an emergency Caesarean section. Alone, the nurse must attend to a patient about to deliver.

The case study uses video to introduce the user to the laboring patient and her husband as she is being admitted to the hospital. As the case unfolds, the student selects information for assessment purposes and, in some cases, is required to actively participate in the data collection process. As labor progresses on an hourly basis, the student selects appropriate interventions based on identified nursing diagnoses. The first module of this two-part program ends with the delivery of the infant. The second module guides students through the process of providing family-oriented nursing care immediately following the birth of the infant.

In an effort to capitalize on the strengths of videodisc technology, the developers focused on the visual, tactile, and auditory capabilities of the InfoWindow system. Examples of the visual information shown include graphic overlay of the fetus over the mother's

abdomen, fetal monitor assessments, varying patient behavior during labor and delivery, placenta examination, APGAR scoring, position and descent of the fetus into the birth canal, graphics of clinical data, and patient support measures. Tactile demonstrations were best used in the simulation for the vaginal examination for cervical dilation, hand placement for examination for Leopold's maneuvers, and scrub sequencing in preparation for delivery. Auditory highlights include the sounds of labor, delivery, bonding, the newborn cry, verbal cues, and determination of both fetal and newborn heart rates.

Students work their way through a case study on the videodisc system that condenses a normal 14- to 24-hour labor into a two- to four-hour learning experience. The program prompts students to use their judgment and problem-solving skills to perform interventions when necessary, and advises them whether or not they made appropriate choices.

University of Colorado

The Office of Educational Services at the University of Colorado Health Science Center has produced *Level III Videodisc-Based Neuroanatomy Course* to provide an alternative to the lab section of an introductory anatomy course. The project consists of a series of 25 computer-generated modules with associated quizzes on basic neuroanatomy. The videodisc serves as an image bank which replaces dissection with a series of stills. The content for the course was developed by Jack Nolte, who has also authored a basic neuroanatomy text, *The Human Brain* (C.V. Mosby, 1981).

The University of Colorado also worked with the University of California-Davis to develop an interactive video program for teaching sophisticated life-supporting procedures for hospital emergency departments. The program, *Computer-based Teaching and Evaluation of Thoracotomy Skills*, received an award at the American College of Emergency Physicians meeting in Washington, DC.

University of Delaware

The University of Delaware College of Nursing has developed an interactive videodisc series focusing on bereavement support. *Death: Perspectives for Clinical Practice* is composed of five interrelated units which encompass the cognitive and affective components of bereavement counselling. The series also provides opportunities for the implementation of support strategies in a simulated clinical setting.

The foci of this Level Three interactive videodisc series are: 1) the exploration of the learners' death-related beliefs and experiences as they impact on clinical practice, 2) the acquisition and/or review of information relating to death-related issues including the grief process, 3) the acquisition of information related to bereavement support strategies, and 4) the integration of personal awareness and didactic learning in the facilitation of the grief process.

Societal Symbols of Death and Grief. An examination of the symbols used by society to memorialize the dead provides insight and a historical perspective to how death and grief are viewed by society.

Arrangements Following a Death. The purpose of this unit is twofold: 1) to give healthcare providers a body of factual information related to the whole process of body disposition and associated arrangements, and 2) to sensitize healthcare providers to the

immediate decisions facing survivors and to the fact that these decisions are influenced by cultural and religious beliefs.

Death-related Legal Issues. This unit also has a dual purpose: 1) to provide healthcare providers with a body of factual information regarding legal issues relating to death, and 2) to help the learners identify their personal reactions to death-related legal situations.

Death Ceremonies and Rituals. This unit is designed to provide both factual and experiential information about funeral ceremonies and customs of a selected number of religious and cultural groups.

Bereavement Support Strategies. This unit both explains and demonstrates selected support strategies for healthcare providers to use when interacting with bereaved individuals. The demonstrations exemplify the use of six strategies as they are implemented in a case example that spans the grief process from the pronouncement of death to eighteen months later.

University of Florida

University of Florida College of Pharmacy recently finished *Communication Skills in Community Pharmacy* to familiarize and test students' communication skills in the areas of interview and assessment, counselling, and consultation. The program is divided into three modes: an educational mode, a test mode, and a small communication skills package. The educational and test modes address all aspects of interview and assessment skills, problems in counselling clients or patients, and consultation with physicians regarding drug interactions.

University of Georgia, College of Veterinary Medicine

The Department of Veterinary Medicine has organized a group of schools to contribute to several veterinary pathology slide collections discs. One of these discs is *International Veterinary Pathology Slide Bank Disc* which contains 3000 slides of gross pathology lesions in domestic animals. Images were contributed by 26 veterinary schools in the U.S., Canada, and Europe. All entries are catalogued using Dbase III. The catalog includes 1) frame number, 2) species, 3) body system, 4) organ, 5) key word, 6) diagnosis, 7) contributor, and 8) contributing organization. Several schools have written instructional programs based on the disc (e.g. University of Georgia, Oregon State, Tuskegee).

University of Hawaii

The University of Hawaii School of Medicine has developed a program entitled *Cyanotic Premature Babies* designed to assist medical students and pediatric residents with diagnosis and management of premature infants exhibiting cyanosis. The program consists of six diverse case simulations, with additional information available on diagnosis, procedures, and relevant drugs.

Respiratory difficulties accompanied by cyanosis are a common problem in premature infants at or just after birth. However, the full diversity of causes is rarely seen in a short training period. This program was developed to assist students and residents with the diagnosis and management of a variety of conditions which they may not see during their training.

The program begins with a menu which permits selection from six cases covering the following: a congenital heart disorder, sepsis/pneumonia, persistent fetal circulation, diaphragmatic hernia, tracheo-esophageal fistula, and respiratory distress syndrome proceeding through patent ductus arteriosus to pneumothorax.

In each case the student is provided with relevant introductory information and must then proceed with diagnosis and management. At each decision point the student may view information about relevant procedures, obtain assistance with diagnosis, or see information about useful drugs. Segments between decision points may be repeated if required. Provision is made for review of instructional segments.

Cyanotic Premature Babies was authored using IBM InfoWindow Presentation System and run on InfoWindow or compatible systems. The extensive graphics in the program were developed with Storyboard Plus using 640x350 resolution mode. This program is one of a number being developed for the Health Sciences Interactive Videodisc Consortium and was funded, in part, by the IBM Corporation. The University of Hawaii is preparing five modules for the HCIVC: *Cyanotic Premature Babies I & II* and *Procedures in Pediatrics I, II, and III*. The first two modules consist of six case studies that require students to make decisions on managing a patient by selecting from menus on the videodisc touchscreen.

University of Illinois at Chicago

The Center for Educational Development at the University of Illinois-Chicago, with support from Metropolitan Life, has produced two programs on interactive videodisc. Each program was developed to demonstrate the potential of interactive videodisc technology and to determine the cost and feasibility of such productions.

Emergency Room Physician. The first program is designed to provide a simulated clinical experience for 2nd and 3rd year medical students. Shot primarily from a subjective perspective, the program provides the student with all of the resources normally available to a hospital physician treating a trauma case, including diagnostic imaging, laboratory testing, consultations, and referral services. Natural language inputs are accepted by the program, which recognizes approximately 800 synonyms in a variety of medical areas.

Back Stress and Body Alignment. The second program is intended to raise health awareness among the general public regarding back care. The viewer is introduced to the program and offered a few simple interactions with the equipment before taking a short risk assessment test. Responses to the test determine which interactive program segments the viewer will see, although an index is available for more in-depth exploration following each individual program segment. Segments include lessons on anatomy, motion, balance, strength and flexibility, disease, diagnosis, and prevention. The segments are structured around the demands of modern life and include practical hints to consider in selecting furniture, buying proper shoes, exercising, lifting, and driving. In addition, the program offers background information and bibliographical references for viewers who wish to pursue further research on program topics. Each videodisc has been pressed and is being programmed for an Apple IIe computer with Microkey graphics overlay board. IBM compatible versions are planned.

University of Illinois at Urbana-Champaign

The University of Illinois College of Medicine at Urbana-Champaign has developed a videodisc/computer system that provides access to a large knowledge-base of pathology. Known as the Expandable Computerized Learning and Inquiry Into Pathology System (ECLIPS), the system provides textual, pictorial, and graphic information, as well as bibliographic references and abstracts of selected current literature. The prototype disc contains approximately 2500 illustrations.

University of Iowa

One of the first to develop computer-controlled videodisc instruction for the health sciences was the Weeg Computing Center at the University of Iowa. The Center has developed at least four interactive programs for health professionals. Two early videodiscs, *Gynecology Patient Education* and *Urology Retrieval*, were developed in 1982 and intended as research and development projects. The gynecology project was designed to introduce cervical cancer patients to the treatment they would receive at University Hospitals, while the urology disc demonstrated a videodisc-based information storage and retrieval system. Because of the experimental nature of the projects, neither disc is available to the public, but may be viewed at the Weeg Center.

The third videodisc produced by the Center has been the recipient of several awards, including a "Best Educational Production" award by the Nebraska Videodisc Group. *Assessment of Neuromotor Dysfunction in Infants* is designed to teach health professionals to identify early signs of neuromuscular dysfunction on the basis of five parameters: muscle function, reflexes, movement, structure, and gross motor skills. The latest project from the Weeg Center is *Lamaze: The Nurse's Role*, which presents the principles of the Lamaze method of childbirth to nurses and nursing students. The disc was produced as a joint project of the College of Nursing and the Weeg Computing Center under a special projects grant titled "The Use of Microcomputers in Continuing Nursing Education."

Pathology of the Eye. A team at the University of Iowa also is producing interactive videodisc modules on ophthalmology, pediatrics, psychiatry, and dentistry for the Health Care Interactive Video Consortium (HCIVC). One module, *Pathology of the Eye*, is expected to fill a critical national void in medical education at those institutions without the services of an ocular pathologist.

Pathology of the Eye takes full advantage of the videodisc system to superimpose computer graphics over clinical photographs, gross photographs, photomicrographs, and electron micrographs. Users may turn graphic help on and off, according to their training and interests. They can request a magnified view of slides and see additional visual examples of a concept. The course contains 13 different sections, a glossary of over 300 terms linked to videodisc images, and two different forms of self-assessment. It is estimated that it will take students a minimum of 40 hours to complete the course.

University of Iowa Dental School

The University of Iowa College of Dentistry has developed a series of computer videodisc patient simulations to train dental students in problem-solving skills. The program, *Oral Disease Simulations for Diagnosis and Management* (ODSDM) consists of a

videodisc with an extensive image bank combined with a computer program that delivers multiple case studies. To date, 30 patient simulations have been created, with potential to create a total of approximately 9,000 case studies.

The ODSDM program consists of five major sections:

Case Summary presents the patient's chief complaint and the clinical visuals, which are accompanied by written descriptions.

Investigation enables the student to gather information about the patient's chief complaint, medical and dental history, and clinical findings. To ask questions, students select from a prepared list (versus natural language "interviews"). The rationale for this technique is threefold: 1) so that typing skills do not create an advantage, 2) research regarding natural language entries does not prove it superior to other methods, and 3) menus permit questions to be grouped into meaningful categories--which is desirable based on research demonstrating that organization encourages students to learn a systematic approach to information gathering.

Clinical Impression makes use of a decision tree to encourage students to develop an alternative to a "shot-gun" approach to diagnosis. The decision tree encourages the student to make a series of deductive decisions rather than one diagnostic judgment.

Management is available to the student after entering one clinical impression. This emphasizes that a clinical impression precedes patient management. The patient's management consists of a series of treatment decisions which may include a diagnostic test or a consultation with a specialist. In their management, students are limited to one definitive treatment, encouraging them to focus on the most essential treatment.

Critique contains the student's scores and the correct diagnosis and management. An expert describes the information vital to decision-making and provides a rationale for each clinical impression and management decision. A printout repeats the Critique and the student's clinical impression and management. This enables students to immediately compare their decision-making with an expert's.

New patients may be created for the program using a patient simulation template. In the Case Summary the author specifies the patient's chief complaint, age and sex, and describes the clinical visuals. For Investigation the author writes a response to all patient specific questions. In Clinical Impression and Management the author specifies the correct path through the decision tree and the score for each correct decision. In Management the author also describes the results for each relevant diagnostic procedure. The Critique requires the author to summarize the vital information for Investigation and to write a rationale for each decision in Clinical Impression and Management.

The College of Dentistry and the University Video Center will also be producing a videodisc dedicated entirely to dental images. It will contain approximately 80,000 still images, representing more than 9,000 patients from eleven departments. Histology and radiograph databases will also be included.

In addition, the Department of Oral Pathology and Diagnosis, the College of Dentistry, and the Weeg Computing Center are developing a prototype computer network system to assign patient simulations to students and to provide grading reports to faculty. Other departments within the College of Dentistry, the Department of Sports Medicine, and the Colleges of Pharmacy and Medicine are modifying and expanding the ODSDM to meet their own instructional needs.

University of Maryland Dental School

The Dental School at the University of Maryland has formed a focal group for dental informatics. Originally funded by the American Association of Dental Schools, the program was hindered by the regular change of officers and organizational direction. The group also receives funding from some participating schools and a hardware support group. A membership fee of \$1200 includes a videodisc player and software. The group is currently working on a slide collection involving ten university dental schools and two international organizations.

Generic Dental Disc. The Information Resources Management Division and the Educational and Instructional Resources Department at the University of Maryland at Baltimore have developed a generic dental disc which contains more than 3000 dental images and 10 minutes of motion video. The disc is designed to provide an image base in dental education to promote Level I and Level III applications for student, faculty, practitioner, and patient education.

The disc contains information contributed by the University of Maryland, University of Iowa, Mount Zion Hospital, the American Academy of the History of Dentistry, Medical College of Virginia, Pan American Health/World Health Organization, and the American Cancer Society. Educational programs are being written using the OAYSIS authoring system (OnLine Computer Systems) and for a hardware system which includes an OnLine GL-512 graphics overlay board.

University of Maryland University College

The Center for Instructional Development and Evaluation (CIDE) at the University of Maryland University College has produced a number of health-related videodisc programs for the Navy. One of their projects involves adapting existing film footage to videodisc to provide refresher training on basic anatomy and physiology. This "repurposing" effort includes four videodiscs containing more than 20 lessons and is titled *Anatomy, Physiology, Pathology: Linking Concepts*.

University of Medicine & Dentistry of New Jersey

The University of Medicine & Dentistry of New Jersey has developed a videodisc program titled *Course on Health Communications*. The course is built around a series of six scenarios which involve health professionals' interactions with each other and with patients and families. Each of the six sections includes: 1) a scenario, 2) a computer-assisted tutorial which discusses critical incidents in healthcare communications, 3) a diagnostic section in which the learner identifies key variables in outcomes of interactions and alternatives for resolving interpersonal conflict, and 4) an evaluation component.

University of Miami

The University of Miami School of Medicine developed "*Harvey*" *Cardiology Patient Simulator* in 1985. "Harvey" is an electronic manikin designed to simulate the bedside findings of dozens of cardiac disease states. The accompanying videodisc program provides instruction on the use of "Harvey" and also provides background data for each disease state that "Harvey" simulates. These include matched historical, physical, electrocardio-

graphic, radiologic, noninvasive, hemodynamic, therapeutic, pathologic, and epidemiologic Information.

University of Minnesota

The University of Minnesota, in conjunction with the Nebraska Videodisc Design/Production Group, produced an experimental disc titled *Intervention: Chance for Change*. The program is designed to promote discussion about, and increase awareness of, inappropriate and appropriate individual and group intervention strategies regarding alcohol use. The focus of this Level I program is on one family's attempts to intervene in a retired man's drinking cycle. The "Ineffective Attempts" chapters show the man interacting with his son, daughter-in-law, grandson, and a long-time friend as they make various attempts to help him. The "Appropriate Efforts" chapters show the more appropriate interactions of the family and friend with the man after seeking the help of a counselor. The "Group Intervention" chapters provide an introduction to group intervention and an example of a group intervention with the man, his family, his friend, and a counselor. Much of the material on the videodisc was adapted from "The First Step," a television program produced by the University of Mid-America for the Survey of Alcohol Information series "Loosening the Grip."

University of Missouri

The Missouri Institute of Psychiatry, affiliated with the University of Missouri-Columbia School of Medicine, has produced a videodisc program to teach chronically mentally ill patients stress management and other skills necessary to remain out of the hospital. *How to Get Out and Stay Out: the Story of Cathy* begins with the main character, Cathy, being released from a psychiatric hospital. She encounters a problem on her first day out. The viewer, using the touch screen, makes a series of choices such as whether she should take her medication and whether she should engage in self-help activities such as talking to people and relaxing. There are eight possible endings to the story, ranging from Cathy being rehospitalized to Cathy thriving in the community. The ending is dependent upon the number of positive choices made by the viewer.

AI/RHEUM. The Information Science Group and the Division of Immunology/Rheumatology at the University of Missouri-Columbia School of Medicine has developed the *AI/RHEUM Knowledge-Based Consultant System in Rheumatology*. The AI/RHEUM system, developed in collaboration with the Department of Computer Science at Rutgers University, uses artificial intelligence techniques to provide non-rheumatologist physicians with advice in the diagnosis and management of rheumatologic problems. The system is being extended and further validated at the National Library of Medicine by members of the original project team.

Also developed at the University of Missouri-Columbia School of Medicine by the Information Science Group is *AI/LEARN: An Interactive Rheumatology Teaching Videodisc*. *AI/LEARN* is a computer-controlled, educational videodisc system which teaches important rheumatologic observation skills. Observational skills are taught by presenting pairs of images on a videodisc and asking the student to determine which image represents a specific feature.

University of Nebraska

Three interactive videodiscs have been developed by the Nebraska Videodisc Design/Production Group to teach Introductory college-level biology, chemistry and physics. Known as the Nebraska Interactive Videodisc Science Instruction Project, the discs are designed to enable students to simulate science laboratory experiments via a personal computer interfaced to a videodisc player.

The project was one of the first funded in 1981 when The Annenberg School of Communications announced initiation of a 15-year grant program providing for annual awards of \$10 million to the Corporation for Public Broadcasting. The intention of the grant is to help fund projects designed to furnish institutions of higher learning with significant new educational programming resources and to explore new ways of advancing higher education through telecommunications.

University of Puget Sound

A videodisc-based tutorial on biomechanics for allied health students has been developed at the University of Puget Sound in Tacoma, Washington under a grant from the Health Foundation. The purpose of the program is to provide occupational and physical therapy students with supplemental experiences in a required anatomy/biomechanics/kinesiology course. Although some students have taken college physics as a preparatory course, others have not and experience difficulty grasping concepts of forces, vectors, torque, etc. without this background.

The program begins with an introduction designed to heighten the students' attention and explain the procedures used in the tutorial. A topics menu is then presented which includes Forces, Vectors, Laws of Motion, and Torque. Students have constant access to a glossary which gives definitions and further background information on terminology and principles which are presented during the tutorial.

In the presentation of material, students are shown examples of the concepts discussed through video scenes of human action as well as graphics and animations. Throughout, students are asked to work practice questions based on the video images, and are given detailed feedback according to their answers. At the end of each sub-unit students are given a quiz, which the computer grades. When the student feels ready, the post-test is given and graded.

The tutorial runs on a Macintosh computer using the Beatles movie *Help!* produced by the Criterion Corporation. Authoring was done using the *Course of Action*. The second phase of the Health Foundation grant will be the production of a teaching module on the early assessment of movement in infants to identify children at risk of developing motor handicaps.

University of Southern California-Los Angeles

The Annenberg School of Communications at the University of Southern California, Los Angeles, has produced a videodisc on hairloss, one side effect of some treatments for cancer. It is currently under evaluation at the Cedars-Sinai Comprehensive Cancer Center, and will shortly be in three other Southern California sites.

The disc offers chapters which answer the following questions: 1) What causes hair loss?, 2) How will hair loss happen, and what to do about it?, 3) How will hair loss feel physically?, 4) How will hair loss affect feelings, family, and friends?.

After the user chooses a chapter, he or she is then asked to pick a level of information, General, Detailed, or chapters designed for "significant others," close friends, and family members of the cancer patient.

University of Southern Alabama

The University of Southern Alabama Department of Family Medicine has completed a generic disc designed to provide students with a simulated doctor-patient interaction with which they can practice their clinical skills. The disc contains 560 short video segments which can be used to program a clinical simulation. Patient complaints include chest pain, abdominal pain, otitis media infection, urinary tract infection, upper respiratory infection, and pharyngitis. The disc is programmed to permit the complaints to represent a variety of problems. For example, the complaint of chest pain may represent organic heart disease or esophageal spasms, depending on how the simulation was programmed. One hundred still frames on the disc contain X-ray, EEG, bacterial smears, etc, to support the physical exam and eventual diagnosis.

University of Tennessee

The University of Tennessee, Memphis College of Allied Health Sciences and College of Medicine have produced a Level I videodisc which provides a morphologic review of cytopathologic and hematologic diagnostic material. Designed for use by health science students, residents, practitioners, and faculty, the disc consists of two parts: *An Atlas of Cytopathology* and *The Morphology of Blood and Marrow Cells*. Each part is accompanied by a syllabus with content outline and descriptive listing of each of 5,457 image frames. Several case studies also are included.

University of Texas Medical Branch (Galveston)

An interactive videodisc program has been developed by the University of Texas Medical Branch in Galveston, Texas which is designed to increase awareness regarding older adults. The program, *Health Care of Older Adults: An Overview for Nurses* was developed for a primary audience of practicing nurses and is intended to impact on their attitudes toward the healthcare needs and problems of a geriatric population.

The production of the videodisc was supported in part by the Division of Nursing, United States Public Health Service, Department of Health and Human Services, in Washington, DC, and by the IBM Corporation as part of a healthcare videodisc consortium project. The instructional content of the program relates to geriatrics and gerontology and is divided into seven modules: 1) Nutrition and Health Promotion, 2) Ethical and Legal Issues, 3) Facts and Figures on Aging, 4) Theories of Aging, 5) Aging and the Humanities, 6) Normal Aging Process, and 7) Physical Assessment.

University of Texas – MD Anderson Cancer Center (Houston)

Two interactive videodisc modules have been completed at the University of Texas MD Anderson Cancer Center. *Care of the Immuno-suppressed Oncology Patient* helps

nurses learn to recognize and treat symptoms of infection in cancer patients. *Perspectives in Diagnosing and Treating Breast Cancer* helps keep the practicing physician informed of recent developments.

The first module developed, *Care of the Immuno-suppressed Oncology Patient*, is a self-paced interactive video designed to help nurses assess and manage infections. Nurses play a critical role in managing the side effects and toxic effects of cancer and its treatment, with infection the number one threat. Often the symptoms of the infection are very subtle and are not easily taught in the classroom.

The module shows an actual video sequence of a nurse interviewing a patient and making a hands-on-assessment. The student can choose from five program branches based on the ADPIE Nursing Process Model: assessment, diagnosis, planning, implementation, and evaluation. Each path allows the student to investigate the content in depth. For example, assessment of the patient has three instructional layers: patient vital signs, history taking, and physical examination of 11 body sites.

At various stages the student is asked to make decisions. Should the physician be called? What is the risk of infection? Video motion and graphics reinforce correct choices in diagnosis testing and other areas, with explanations for incorrect choices. The student nurse is also asked to indicate reasons why correct choices were made, again to reinforce learning.

MD Anderson's second module is *Perspectives in Diagnosing and Treating Breast Cancer*. This module is for the practicing physician who wishes to become more familiar with the latest information on diagnosis and treatment. Its main interactive pathways are three prepared case studies and a branch for the physician to construct an individual case study. Supplementary material includes epidemiology, a bibliography, and background on a 90-minute national teleconference used for content of the prepared case studies.

University of Toronto

An interdisciplinary team at the University of Toronto Faculty of Medicine has produced an interactive videodisc on human embryology. The topic was selected as a videodisc project by Lawrence Spero, professor of pharmacology and director of the Faculty of Medicine's Computers in Education program, because of the technology's ability to demonstrate a three-dimensional series of events such as fetal development. Spero worked with the Department of Arts as Applied to Medicine (AAM), which created a computer-generated 3-D embryo model used in the program.

The module also goes beyond basic concepts and includes diagnosis. One segment depicts clinical problems, and the students have to decide at what state of embryonic development the problem arose. Students can return to the tutorial portion if they are unable to answer. "We want students to evaluate their own knowledge and, as they do that, we'll track how they use the program and whether it leads them to ask more questions," said Spero.

University of Utah

The University of Utah Pathology Department is working on their second version of *A Slice of Life*, the shared disc containing 12,500 slides in pathology, histology, neuroanat-

omy, nuclear radiology, etc. Most were contributed by various departments at the University of Utah, with some from the University of Cincinnati Pathology Department and some from the Mayo Clinic. Level III teaching programs are being developed at the University of Utah and other universities to be used with the disc. The cataloging is being done on the Smart System database by Innovative Smartware, Inc.

Using visuals from their shared videodisc *A Slice of Life*, the University of Utah has developed two interactive applications using *HyperCard*.

HyperHeart. *HyperHeart* was developed to aid students in the study of cardiac physiology. The program is divided into five sections: Section One a study of basic cardiac anatomy which combines labeled diagrams on the computer and photographs stored on videodisc; Section Two examines pressure and volume changes in the heart during the cardiac cycle; Section Three uses animation sequences to interrelate those pressures and volumes with the blood flow and corresponding muscle and valve contractions.

Section Four features synthesized heart sounds, synchronized with ECGs and Phonocardiograms. Finally, Section Five provides an overview of ECGs and explains how they are measured and recorded. Common abnormalities are introduced, as well.

HyperBrain. *HyperBrain*, another *HyperCard* application, was designed as a core resource for neuroscience education. Currently in use by first-year medical students at the University of Utah in their Neuroanatomy class, the program is intended to either complement, supplement, or substitute for a traditional neuroanatomy laboratory. *HyperBrain* is linked with the *Slice of Life III* videodisc. It contains fourteen chapters, followed by quizzes, as well as animated pathway diagrams taken from Duane Hanes' Neuroanatomy Atlas. The program is complemented with a series of fourteen videotapes, as well.

HyperBrain features multiple linking characteristics. All terms in the glossary are linked instantaneously to an illustrated glossary. All digitized figures are labeled and linked to the glossary. A core of resources permits the student to access atlases (in three planes), animated reflex diagrams, neurological cases, or the videodisc index. The program is designed to expand with pathology, radiology, and other modules that are under development elsewhere and are designed to fit into the shell as independent or supplementary modules. A module on cellular neurobiology is being developed in Virginia; chemical neuroanatomy will be completed in Cincinnati, and neuropathology in Michigan, Cincinnati, and Utah.

Slice of Life Videotape Demo. The University of Utah has produced a 90-minute videotape titled *Creating a Slice of Life*, which shows how the original videodisc was made and demonstrates six interactive applications in the areas of Neurosurgery, Pathology, Neuroradiology, and Neuroanatomy—including a demonstration of *HyperBrain*. The tape is available through Stewart Publishing for \$45.

University of Washington

The Health Sciences Center for Educational Resources at the University of Washington is marketing six of their medical videodiscs. They are produced as multi-use or generic discs to allow individuals and institutions to tailor their instruction to the needs of their particular site. Each disc may be played on any optical reflective disc player.

Medical Applications Videodisc: Hematology was originally published in 1982 and was one of the first to be distributed to the Miles Laboratory's Learning Centers. The sec-

ond edition contains more than 6000 slides, including those from the American Society of Hematology morphology collection (2674 frames), the World Health Organization International Histologic Classification of Tumors (1866 frames), and Selected frames from the Western Universities Physical Diagnosis Slide Bank (1782 frames).

Acute Leukemia Morphology II is a one-sided disc that contains numerous exemplary peripheral blood smears, bone marrows, and special stains for instruction and reference in the differentiation of the acute leukemias. Scans of the material at various powers augment the study of the still microscopic features of the cases in question.

Disorders of the Nervous System: Motor is a compilation of materials from a "visual glossary" collection of neurological dysfunction. Normal and abnormal gaits and reflexes are demonstrated as well as a wide variety of motor signs and disorders.

Disorders of the Nervous System: Mentation is a compilation of material from a "visual glossary" collection of neurological dysfunction. Included are six patients who demonstrate a variety of disorders of mentation.

Trauma Training Materials I and II: These two discs (three sides) demonstrate basic techniques that must be mastered by a trauma care team working in an emergency room setting.

Laboratory Medicine Video Library: Atlas of Hematology: This one-sided disc contains over 6000 stills and scans recorded directly through the microscope and forms a comprehensive library of hematologic findings which can be used for education, testing, and reference. All material is SNOMED encoded to facilitate access.

Cardiovascular Resources Videodisc contains a large collection of materials that may be used to teach cardiovascular nursing and medicine. The collection includes approximately 4000 slides covering anatomy, physiology, embryology, microscopic and gross pathology, introduction to care environment and common techniques in the assessment and treatment of cardiovascular disorders.

All of these videodiscs come with a catalog of images that allows rapid access for lecture demonstration or self-study, as well as the compilation of written or computerized instructional programs.

Hypertext Software. The University of Washington has produced hypermedia software to accompany two of their generic videodiscs. The programs are written for Owl International's *Guide*.

Acute Leukemia Morphology—Guide is an interactive Guide program that allows the student to compare and contrast the Acute leukemias by classification (M1-M6 & L1-L3). Major morphological and staining characteristics may be viewed on the videodisc. Patient information accompanies each example. The program sells for \$99 and operates with Pioneer LD-V6000 series videodisc players and the videodisc *Medical Applications Videodisc: Hematology 2nd Edition*.

Laboratory Medicine Acute Leukemia Series is a series of three Guide programs that allow the student to interactively explore the Acute Non-lymphocytic leukemias, Hairy Cell Leukemia, and Multiple Myeloma. Each program contains material on the laboratory presentation and morphology of the disease, special stains and staining characteristics, and pertinent references. Sells for \$99 and operates with Pioneer LD-V6000 series videodisc players and the videodisc *Laboratory Medicine Video Library: Atlas of Hematology*.

University of West Florida

The Office for Interactive Technology at the University of West Florida was selected in 1981 to design and produce the series of programs on Aid to Families with Dependent Children (AFDC) for the Florida Department of Health and Rehabilitative Services (HRS). The program was designed to train newly-hired workers (approximately 500 annually) to be Public Assistance Eligibility Specialists who determine whether applicants are eligible to participate in the AFDC program. The completed package consists of 160 hours of instruction, nine videodisc sides, 78 floppy diskettes, eight printed reference books, and an extensive trainer's guide.

The OIT also produced *Court Testimony and Documentation* in 1983 for the Children's Medical Services Program of the HRS.. The program was designed to provide Child Protection Teams (multi-disciplinary team that deals with child abuse) with skills in court testimony and documentation.

Virginia Commonwealth University, Medical College of Virginia

The Medical College of Virginia (MCV) at Virginia Commonwealth University has developed the first in a series of classic dog laboratory videodiscs designed to teach the physiological effects of procedures and drugs on the cardiovascular system. The series is entitled *Laboratory Experiments in Basic Health Sciences: Cardiovascular Physiology*.

The first disc in the series, *Cardiovascular Physiology*, consists of more than thirty experimental procedures and drug injections along with their effects on cardiovascular functions. An actual dog laboratory was videotaped as it was performed by two physiology professors, George D. Ford, PhD and James L. Poland PhD. These professors also provided the physiological content for each procedure and drug. Jane Terpstra, the instructional designer, planned the interactive videodisc and developed the IBM-based tutorial. MCV graduate physiology students reviewed and evaluated the pilot program, which led to revisions in the program format. The remainder of the program is being completed.

An interactive tutorial guides learners through the experiments, teaches the physiological effects of each procedure and drug, and tests for content mastery with visual and verbal items. Using a videodisc player remote control unit, the videodisc becomes a lecture tool to present experiments and their resulting effects on the cardiovascular system.

Weber State College

The Weber State College Emergency Care and Rescue Program recently completed a program titled *Paramedic Training: Myocardial Infarction*. Funded by the Marriott Corporation, the disc trains emergency medical personnel in prehospital treatment of myocardial infarction. The program opens with linear video which simulates a person having a heart attack. This material is used to teach the recognition and treatment of acute myocardial infarction. The learner may then branch to any of seven interactive teaching segments which relate to the linear program. They are: 1) Anatomy and Physiology of the Cardiovascular System, 2) Pathophysiology of the Cardiovascular System, 3) Risk Factors, 4) Complications, 5) Signs & Symptoms, 6) Assessment, and 7) Treatment. The program also instructs learners in a psychomotor skill: the proper use of a cardiac monitor. An evaluation of the program effectiveness has been conducted with very favorable results.

Wright State University

In 1989 Wright State University received funding of approximately \$100,000 from the Charles F. Kettering Foundation for the development of interactive video projects. The first is an interactive video program designed to teach the families of critically ill patients the principles of cardiopulmonary resuscitation (CPR) and give them an introduction to the Intensive Care Unit. The program is intended to decrease the anxiety and emotional shock the families experience as they walk into an intensive care room. The second stage of the project will expand the program to include the risk factors of heart disease, how heart disease develops, and what can be done to modify risk factors positively. It also include information about resources in the community that can be used to help modify these risks.

A second project is the development of another patient education program that will be used for stress reduction in oncology patients. Much of the video production will be done through the Kettering Medical Center.

Worcester Polytech Institute

See Worcester State College.

Worcester State College

A consortium of local organizations in Massachusetts, on a reported budget of less than \$5,000, has produced an interactive video prototype for hospitalized adolescents. Known as Project BODY WORKS, the project was founded on the hypothesis that mind-stimulating activity can reduce stress felt by adolescent hospital patients.

The prototype videodisc program is designed as a simulation where the learner plays the role of a physician. The learner must diagnose a small boy who, as it turns out, has appendicitis. Information about the illness is obtained from the boy and his mother by typing "plain English" questions into the computer. The computer recognizes key words or their synonyms and provides the learner with appropriate computer text or videodisc segments.

Yale University

A video echocardiography videodisc was prepared in a joint effort between Yale University and the Educational Technology Branch of the National Library of Medicine. The case material on the disc is divided into more than 1200 segments which may be viewed in an "endless loop" moving sequence or as still frames. The videodisc is incorporated into an instructional program for use with either Macintosh or IBM-compatible computers. On the Macintosh, the program was developed using *Hypercard* and uses a mouse to access any segment of the instructional module. In the IBM environment, the program runs on the Infowindow hardware system, which uses touch-screen technology for user interaction.

The instructional material is offered in a non-linear sequence where the user is allowed to pursue the curriculum material as directed by curiosity rather than by the instructor. In addition, the program is designed to be visually exciting since it contains an excellently designed graphic interface and uses both sound and animation as a way of enhancing the information displayed on the videodisc. The use of graphic animation clarifies and

simplifies complex image structure, thus preparing the student to make the pertinent observations on the video image. Moreover, when pathology is presented, the student is easily able to replay normal segments and directly compare each sequence so that a better understanding of the nature of the pathology can be achieved.

Patient cases were selected from more than 14,000 diagnostic studies performed over a 12-year period at Yale-New Haven Hospital. More than 160 individual cases were selected for use on the disc, exceeding the number of clinical cases the American Society of Echocardiography recommends for basic training in echocardiography. Virtually the full spectrum of echocardiographically diagnosable diseases is available on the disc so that a full range of severity and image quality is available to create a realistic environment. Although much of the videodisc content stresses two-dimensional real-time imaging, all other techniques such as M-Mode, pulsed and continuous wave Doppler, and color Doppler are fully represented where diagnostically appropriate. In addition, there are segments on transesophageal echocardiography (TEE).

Chapter 4

Hospitals

Hospitals have always been viewed as one of the largest potential markets for the development and sale of interactive training materials. On the surface, this was a reasonable expectation considering the fact that training costs in U.S. hospitals exceed 10 billion dollars a year. However, due to dropping occupancy rates and pressure to reduce both the length of stay and the cost of care, hospitals are experiencing an economic crisis which, in turn, is squeezing education and training budgets.

Hospital Education/Training Market

Most videodisc suppliers consider hospitals to be the prime targets for their health-related programs. In fact, most commercial efforts in healthcare industry have been directed to either continuing education or staff training in hospitals. To understand the magnitude of this market, consider the following:

- There are more than 7,000 hospitals in the United States, employing more than a million licensed nurses and almost half as many physicians.
- At least 22 States *require* that licensed physicians and nurses maintain accreditation through continuing medical education (CME) training.
- It is estimated that practicing nurses receive more than 75 percent of their education in the hospital environment. Practicing physicians receive approximately 50 percent of their training in the same environment.

Cost Considerations

Not only is continuing education widespread, the costs to hospitals for maintaining these training programs is tremendous. Estimates taken from data published by the American Medical Association and other sources indicate that the total cost of hospital-based continuing education programs for physicians, nurses, and paramedics is approximately 2.5 billion dollars per year. Nearly another billion dollars is spent by pharmaceutical companies, medical equipment companies, and other medical product companies on programs related to training hospital personnel.

One of the major reasons administrators may look to videodisc training is for the potential cost savings. Though not fully documented, it has been shown that people learn at least as well--and frequently better--using videodisc programs as opposed to traditional teaching methods. A major cost advantage lies in the fact that videodisc training systems can be brought into the hospital where there are available to the staff 24-hours a day. In

this way, the hospital staff can train during normally slow periods, thereby reducing the cost to the hospital in lost productivity.

Slow Market Growth Predicted

Even with the obvious training need hospitals have, most videodisc hardware and software suppliers have been disappointed with the cool reception the hospital community has given commercial videodisc programs. Based on the experience of these suppliers, it seems that the market for interactive videodisc training programs in hospitals will develop slowly over the next several years.

Many predict that only hospitals with 300 beds or more will be realistic targets for the purchase of videodisc systems initially, limiting the potential market to about 1,500 hospitals. After the price of videodisc systems and software decreases, the availability of videodisc software increases, and the success of the programs is proven in the larger hospitals, the smaller (under 300 beds) hospitals are expected to begin adopting such programs on a large scale.

The reasons for this slower-than-expected growth may be due, in part, to the following reasons:

Hardware Compatibility Problems. One of the biggest concerns of potential buyers is the ability of their videodisc systems to play any and all programs that are on the market. Good videodisc programs are hard enough to find without worrying about whether or not they will play on a particular system. With large libraries to choose from, it would be much easier to justify the expense of a videodisc system. Nobody wants to spend eight thousand dollars on hardware only to find they are limited to the few programs produced by one company. Which leads to the next problem.

Limited Videodisc Libraries. There is a severe shortage of any videodisc programs, much less good ones. Of the 437 programs listed in the *1989 MedicalDisc Directory*, only about 100 were available for purchase. Unfortunately, it is a chicken-and-egg problem. A large selection of programs is not likely to become available unless there is a larger hardware base to market to, and the hardware base is not likely to develop without more good videodisc programs to play on them.

Training Vs. Capital Expense. Most suppliers attempting to sell videodisc programs to hospitals are forced to sell videodisc systems as well. What they are finding is that the training budget, which covers the cost of the software program, does not cover the cost of the hardware delivery system. Hardware purchases, which range from \$6,000 to \$10,000 per system, usually are considered a capital expense and must be budgeted under a different area--a process that may take up to two years to approve.

Resistance to "Generic" Information. Suppliers of videotape programs to hospitals have found that a major resistance to "off-the-shelf" educational programs in hospitals is due to the NIH (Not Invented Here) Syndrome. Most hospital departments have their own way of performing medical procedures, and are resistant to using programs that show another approach. For now, many videodisc developers hope to minimize the effects of this attitude by producing programs on content areas not subject to the NIH Syndrome. A good example of a "safe" program is the CPR Learning System marketed by Actronics, Inc., since their product teaches to standards set by the American Heart Association.

Argosy Network

The Argosy Network Corporation hopes to overcome many of these obstacles by deploying a network of proprietary interactive video learning stations in as many as 300 hospitals throughout the United States. The Network is built around an inexpensive hardware system which will be given to hospitals and will feed via telephone lines from the Argosy office in Nashville. The delivery system consists of a computer, videodisc player, and touchscreen monitor. The videodiscs will be located in the hospitals, but because the control software is delivered on-line from Argosy, hospitals will pay a fee each time a course is used.

Programs used in the Network will be provided by medical manufacturers and pharmaceutical companies who are already spending large sums of money for the training and education of hospital personnel. Users of the Network are presented with a menu of available courses from which they select the desired course. By using an interactive video program, users can interact with the course and receive hands-on instruction and simulate real-world situations.

When a course is completed, the user's record is stored. The record may contain the user's name, date, time, responses to questions, score, or any comments the student may have about the manufacturer's product. The data is then collected by the Argosy computer network and reported back to the courseware sponsors and the user hospitals. This provides the essential feedback and record-keeping that is so important to the hospital, medical manufacturers, and pharmaceutical companies.

Argosy's Market Analysis. Today, hospital training costs are significant. According to the Boston Consulting Group, hospitals typically budget one percent of their total budget for education and training, but usually underestimate the true cost. The total cost for education and training in hospitals is just over \$9.5 billion annually. One study found the "full cost" of education and training to average four percent of the total hospital budget. In most cases, the range is between two and six percent. This implies that the training and education costs to a mid-sized hospital (250-300 beds) is between one and two million dollars annually.

There is also a great concern about the future supply of nurses. The average nurse turnover is 24 percent and, for the last three years, nursing school enrollment has been down 23 percent. In many states nurses are required to take as many as 21 hours per year of continuing education in order to maintain their license. Since many medical manufacturers and pharmaceutical companies already offer inservice training and continuing education tapes, these courses can be developed into interactive programs on Argosy and properly documented to satisfy license and accreditation requirements.

Medical manufacturers and pharmaceutical companies spend a large percent of their marketing budgets on education or in servicing their products. SK&A Research reported in a 1987 report that of the top ten medical equipment categories (monitors, intravenous, defibrillators, ventilators, EKG, lab equipment, suction devices, radiology, invasive monitors, and ultrasound), the average inservice cost on their equipment ran \$8,600 per year per hospital, or \$717 per month per hospital.

Argosy Network Corporation has begun to deploy the first phase of its network in 10 hospitals nationwide during a testing phase that was to be completed at end of 1989. This phase will feature the following courseware: *Right Upper and Middle Lobectomy de-*

veloped by U.S. Surgical and Health Edutech programs *Back Safety*, *Electrical Safety*, and *Fire Safety*. Plans call for growth to 300 hospitals by the end of 1990 with a substantial increase in courseware from manufacturers and pharmaceutical companies.

Future Hospital Markets

Although the majority of videodisc programs developed for the hospital environment have been in the areas of continuing education and staff training, several other areas of hospital education and training show promise for the future.

Patient Education

The first of these areas is patient education. Over the past few years, there has been an increased emphasis on the patient's need to know and right to know about his or her illness, treatment, and recovery. More and more hospitals are budgeting for personnel and programs to meet this need. Videodisc programs are likely to be useful for several reasons: 1) They will always be available to the patient, 2) The interactive nature of videodisc programs can permit the patient to explore specific areas of special interest, and 3) Record-keeping functions of videodisc programs can provide documentation not only that a patient has seen a given program, but indicate his or her level of understanding as well.

Health Promotion

Health promotion programs, or Wellness programs, are also on the rise. Like other businesses, hospitals are offering programs to help improve the health of their employees in order to decrease absenteeism and increase productivity. Many hospitals are even offering health promotion programs to the community both as an income source and a way to improve public relations. As these health promotion programs increase in number and size, videodisc technology will undoubtedly make its way into the market.

Hospital Marketing/Public Relations

There are several hospital marketing programs which lend themselves well to delivery via interactive videodisc systems. One of the most promising is the freestanding videodisc kiosk which stands in the hospital lobby or waiting area. The value of such a kiosk is that visitors can use the program as a directory to the building, a guide to services offered by the hospital, a reference to explain billing or other procedures, a health education resource, or any number of other uses. At least two commercial firms have developed such kiosks for hospitals, and at least one hospital has created its own. These are described in more detail in the chapter titled Marketing/Public Relations.

Hospital Corporation of America

A study conducted in 1986 by the Hospital Corporation of America's Center for Health Studies assessed educational needs and costs of education delivery within HCA hospitals and explored applications for computer-based interactive systems. The first phase of the study addressed educational needs and delivery costs. It concluded that budgeted education costs averaged more than one percent of a hospital's total annual op-

erating cost. Actual costs of education were considerably greater than budgeted costs, because budgeted costs did not include labor dollars associated with employee time spent attending programs. When an estimate of paid employee time and other "invisible" costs was added to budgeted costs, the percentage of annual operating cost spent on education exceeded two percent.

Evaluating Interactive Systems

The second phase of the study examined computer-based interactive instruction in the hospital environment. It addressed: 1) degree of acceptance by both learners and educators, 2) cost effectiveness of interactive instruction, and 3) degree to which existing products address hospitals' ongoing educational needs.

Three commercially available interactive systems (two videodisc, one computer-only) were identified for study. These systems were designed to provide educational programs on CPR (Actronics, Inc.'s CPR/ACLS Learning System), critical/emergency care patient management (Intelligent Images' dexter System), and patient education (Primarius Patient Education System). The systems were placed in six "typical" HCA hospitals for approximately three months.

For the most part, learners and educators responded very positively to interactive systems. They felt they learned from the systems, generally preferred them to live instructors, and commented positively about time savings and availability of feedback.

Cost-effectiveness was most easily estimated when an interactive program directly replaced a discrete program already provided and tracked by the hospital. The Actronics system's programs were best suited to this sort of comparison; significant savings seemed likely where sufficient numbers of learners required training. These savings were due primarily to reduced learner and instructor time and could be applied directly against system cost.

Obstacles to Implementation

The study identified significant obstacles to implementing interactive systems in hospitals. One of the greatest obstacles appeared to be resistance to the initial cost of hardware and programs. Educators and hospital administration were quite sensitive to the capital expenditures and leasing costs associated with interactive systems. This reaction was not always balanced against potential savings from interactive training, which generally fall into the category of "hidden" costs such as employee time to attend programs. Savings of this sort are dependent on effective utilization, do not appear on budget lines, and cannot be directly calculated as cost reductions.

A second obstacle identified was the small number of currently available programs which meet a hospital's most critical educational needs. Most available interactive programs stand alone and are not integrated into more comprehensive programs consisting of a mix of media (print, clinical experience, etc.). Stand-alone programs cannot have the impact on a hospital's training culture that a more comprehensive set of materials might, making stand-alone systems more difficult to promote as being cost effective. Therefore, it appears that interactive delivery systems may have the greatest potential when incorporated into more comprehensive programs targeted at specific hospital training needs.

Exploring the Hospital Videodisc Market

As part of the Washington Videodisc Conference held in October 1987, an expert panel took an in-depth look at the hospital videodisc market. The following was abstracted from the transcripts of their presentations.

The Role of Interactive Videodisc Technology in the Changing Hospital Financial Environment

Ann Huntsman, Human Resources Administrator, El Camino Hospital

Interactive videodisc is very expensive technology to an industry that is under siege. I wrote to my 10th District representative this summer trying to help him understand what this ratcheting down in health care is doing to us and he wrote back and gently reminded me that the House Ways and Means Committee had just cut 1.5 billion dollars from Medicare in order to stay within the budget. Now the lion's share of that cut has come out of the Federal Government's payment to hospitals.

I work in a hospital that probably has a reputation of being one of the better managed organizations in this country. It's a \$100 million operation and when we went through the budgeting process this last spring we were looking at \$19 million in bad debt this fiscal year that just started in July. About 75% of that is what we will not get paid from Medicare for taking care of Medicare patients. Another 15% is what we will not be paid by MediCAL, the California version of Medicare. Another 10 or so percent is human beings who don't pay their bills, so you see where that leaves us. Although we get criticized for not managing well in health care, I think we manage extremely well to survive under those circumstances. You have to understand that when you are talking to us and trying to sell very expensive technology.

On the other hand, we are also under siege because we have developed a voracious and insatiable appetite for health care in this country. I would cite, for example, that our product, patient care, is subject to the most erratic swing of emotional decision-making of any product in any industry that I know of. There are children who receive 2 or 3 organ transplants before they die while at the same time there are children out in East Palo Alto who don't get any dental care until they join the army. I think we are gutless when it comes to making good, tough decisions. When the President of the United States appeals to people to contribute funds for a child to have an organ transplant, you begin to see the magnitude of the emotionalism in the decision-making in health care.

Possible Areas of Application

This is an industry that is looking for creative ways to keep people well and get patients out of the hospital faster. The trend is to provide more services on an outpatient basis. How could video technology help us?

Preoperative/Postoperative Education. What would be helpful in getting people in and out of the hospital faster? Preoperative education, for one. Suppose that a patient could watch a videodisc program to learn about preoperative preparation, what they should be doing, coughing and deep breathing exercising for example. Likewise when

they leave the hospital, the same types of technology could be used to teach them how to manage themselves at home.

Home Health Care. Another burgeoning area is the area of self care. We are reading a lot in the literature now about the sandwich generation, those people who are caught still taking care of their teenaged children and also taking care of aging parents and having to do that in a home setting. We could use programs on how to give a bed bath, how to give an injection, how to do soaks, how to administer ear drops, eye dressings, intravenous therapy, how to change colostomy dressings, those kinds of items.

Staff Training. Other areas that are popular for training relate to the JCAH standards. Programs are needed on back care, electrical safety, and the like. At El Camino we doubled our back injuries in the last 2 years from 24 to 48. It's reflective of the stress of the times and the increasing work load.

Employee Communications. One of the things that I am aware of is the terrible deficit in the area of employee communications, particularly around things like benefits. Interactive videodisc technology is well suited to employee communication regarding benefits and presenting what-if type scenarios. This kind of a program could be offered on three levels. First, to explain all aspects of the benefits plan in detail, including an explanation of what benefits are not included. At the second level, the program could explain the plan in relation to that employee's overall environment, considering factors like spouse's income and other outside income. At the third level, it could provide decision-making information and scenarios of various options that could be described or charted. Presented properly that type of benefits communications program would help the employee make wise choices in selecting options and enjoy their whole benefits program more.

Advantages of Videodisc Technology

Interactive videodisc represents one of the biggest technological advances for development and implementation of health care education and training. With the ability to randomly and almost instantaneously access any one of 54,000 still images, or fewer in combination with full motion video sequences, computer-assisted videodisc players bring to the training and education field the following:

- True individualized self-paced learning through branching instruction that provides for reinforcement and remediation where necessary
- Retention levels of as much as 50 to 100 percent greater than linear videotapes and as much as 100 to 200 percent greater than the traditional classroom and textbooks methods
- The ability to present real life simulations with a variety of what-if situations that permit learners to make judgments and experience the outcome of their decisions. That is what I think is the most dramatic.
- The ability to record learner's choices, learner's progress and test scores in this era of ever increasing expectations and regulations around documentation.

Marketing Approach

When you are marketing to healthcare institutions, you must be able to demonstrate how videodisc technology can save time, money, energy and resources. Many ad-

ministrators and educators in health care do not know what they are presently spending for training, so you must go in with a simple model to help people identify the extent and location of their current costs. I think that was one of the smartest moves that Actronics made when they were marketing that very sophisticated program for CPR training. They came in and helped people identify what we were presently spending for CPR.

One of the things that you might help us do when you approach hospitals is help us find grant sources. You could do a little bit of research and when you are trying to sell to a hospital suggest or co-write with them proposals on where to get grant monies. Another technique that you might use is to identify top flight hospitals, a hospitable environment for new technology and make a deal with them to put your materials in that hospital in return for demonstrations, evaluative information, publicity, and connections with other likely buyers. In health care, as in other industries, the top flight organizations serve as role models for other organizations and it would be beneficial to cut a deal with people like that.

But the biggest problem of all of this is equipment incompatibility. The lack of a standard format makes it very difficult for us when we are at the decision point regarding what we are going to buy. I believe that this is the key to whether or not significant numbers of hospitals will adopt this technology.

The Need for Interactive Videodisc Technology in the Hospital Environment

David Allan, M.D., President, Intelligent Images, Inc.

There's a vast explosion of new knowledge that's going on in the field of medicine. The new technologies, particularly in acute care and critical care, are expanding rapidly and there's an enormous need to keep up to date with these changes. In addition, with the cost containment era, hospitals now have a higher percentage of patients with multi-system disease, which is more difficult to train for than single system diseases. At the same time the resources that are available for education and training are being restricted.

Admissions are declining. The latest figure I have is that hospitals average about a 60 percent occupancy rate. The first thing that goes during a budget cut seems to be education. On a national level, the government's ability and willingness to pay for education as part of the Medicare and MediCal payments is being drastically reduced. As a result of all of these factors, there are immense pressures being put on hospital education and training programs, and I think that the interactive videodisc can help meet a lot of these pressures.

Benefits of Videodisc Technology

I think the interactive videodisc has enormous benefits for the hospitals and these have to be clearly shown as you go out to market this. One of the greatest strengths of interactive videodiscs is that it can teach more than just information, it can also teach how to apply that information by giving immediate feedback and showing the consequences of decisions. Videodisc technology is also very reliable, easy to operate, user friendly, and can be available to all shifts at all times. Interactive videodisc programs have been shown

to increase the efficiency of learning and can teach problem-solving far better than any other medium can do. It can impose real life pressures on the learner without putting the patients at risk. It can provide individualized self-directed learning and can be used repeatedly to improve performance. With interactive videodisc systems you can document both time and performance, print it out, and file the results in the learner's chart. This way, when the JCAH surveyors come around it's much easier to document some type of performance review.

Marketing Problems

The major difficulties we've had in marketing to hospitals have been, first of all, the need to educate the marketplace about interactive videodisc. Cost is another problem area, though I don't think this is an expensive technology. For example, if our 12 programs would be used by nurses in a hospital say, once a year, there would be a cost savings of \$20,000 per year for every 100 nurses. It can clearly be shown that the interactive videodisc is cost effective.

Another, and I think major issue, has been to change people's behavior in the educational process. It is notoriously difficult to change the behavior of hospital people. They have always done it this way and it's always been all right, so why should they change it? I think that as more and more systems are out in schools and in hospitals, the process of change in itself will become easier.

The final major issue relates to the quality of the product being offered. There's been too much emphasis on the technology, on the hardware, and not enough emphasis on what the courseware can do. I think also that it's vital that we develop good materials and we begin to evaluate them properly.

Conclusion

I think that without any doubt, this interactive technology, whether it turns out to be interactive videodisc, CD-I, DVI, or whatever, that it is here to stay. I think if we use it properly and develop high quality courseware and focus that courseware properly, it's going to make an immense impact on health sciences education.

Educational expenditures in hospitals alone are some \$10 billion per year. When you add on top of that medical schools and nursing schools, and the money spent by pharmaceutical companies and medical equipment companies to educate people how to use their products, the total marketplace is just enormous. It must be somewhere around \$20 billion or even more that is being spent on health sciences education.

It's not been easy being a pioneer in this field, but I think the pioneering days have now gone and that by the end of 1988, the 6 percent of hospitals that now have interactive videodisc capability will have multiplied immensely.

Considerations In Marketing Interactive Videodisc Programs In the Hospital Environment.

Danny Cassidy, M.D., Vice Chairman, Actronics, Inc.

The hospital marketplace that we are dealing with can really be defined as 7,000 hospitals, 1,400 or so nursing schools, and 300 or so medical schools, since most programs could be sold to any of those locations. This is a large market, yet Actronics, which has been in existence for quite a few years (since 1984) has placed only around 300 systems and Intelligent Images has sold a total of about 50 systems. As you can see, interactive videodisc has not really penetrated the marketplace very far.

Now if we try to define the marketplace in terms of dollar value, you will understand why there's a lot of entrepreneurs out there trying to produce something that might be sold. SK&A estimated that the average hospital spends between \$300,000 and \$670,000 a year just in its direct trainer cost. This is the cost of personnel to provide the training. Now when you add in lost productivity from the standpoint of employees who are taken off the job in order to be trained, when you look at the cost of items such as videotapes and outside video production, you get into a figure that ranges between \$900,000 and \$2 million per year per hospital that is being spent on education and training. If you just take the midpoint of those estimates, that equates to a \$10 billion a year industry just in the hospital marketplace. So I think everyone would agree that it's probably a worthwhile marketplace to go after.

Positive Features of the Hospital Market

Now, what are some of the good features of this marketplace? I think probably most important is that it's easy to find a large number of generic needs. Certainly the problem of infections in hospitals is a chronic need. The need for CPR training is a very well-defined need. Most of the major problem areas of the hospital, or the areas where education is needed, can be thought of in very generic terms.

Also, there's no question the need for training is very high. Hospital training is already being regulated and will continue to be regulated to even higher degrees, by the accrediting commissions, Federal agencies, the insurance industry, you name it. Somebody's going to get into the picture and decide that there's another requirement that needs to be met in order to safeguard the health and care of patients. So obviously they have a need.

Another positive factor is that, by and large, there is a great deal of interest in the healthcare industry in new technologies. They are used to new ideas, they are used to new methodologies of doing things, many of the initial products that were developed in the interactive videodisc area were developed in medical schools or for hospital training. I think another important consideration is that hospital personnel are dealing with CAT scans, electronic systems to calculate the lab values, electronic distribution systems—they are living in a day-to-day world that involves lots of electronics and lots of high technology. As a consequence, you do not have to deal with the technology phobia that might be encountered in other marketplaces.

Negative Features of the Hospital Market

Unfortunately, there are some negative features of the marketplace as well. I think the lack of centralization of training is a major, major problem area. Take a typical subject like cardiopulmonary resuscitation. In an average hospital you have a nursing inservice program that is providing CPR training for its in-house staff, you have a medical staff education program where the physicians on the staff are getting their training, and you also have all the nonprofessional staff to be trained and that's under another department. In addition to that, you have medical and nursing students taken care of by another location within the hospital. If you have a program that's involved with training the parents of high-risk infants in how to do CPR before they take the child home, or a program that's associated with the coronary care unit so that whenever a patient comes into the hospital and the family needs to have CPR training before they leave the hospital, that inpatient education is handled by another department within the hospital. And of course, last of all but still very important, you have the whole marketing effort of the hospital that might include community outreach programs that are teaching CPR to the public.

That lack of centralization really makes it very, very hard for you to know who to call on. In addition, while their total number of people that need to be trained each year in a hospital might 500 to 2,000, no one single department may have a significant chunk of that activity that justifies their expenditures in this area.

Not Invented Here. Another major problem if you are really out there getting into the hospitals and talking with people is what I call the not-invented-here syndrome. Let's face it, virtually every doctor on every staff and every nurse educator in the hospital is an expert in their area of medicine. As a consequence, they have their own preferences or their own variations on a theme that are the rule at their location. They are looking for a unique way of doing a procedure that is impossible to present if you are producing a generic version of a program.

Perceived Inability To Pay. I think one result of the noncentralization education and training is that the staff educators, nurse educators and physician educators each perceive themselves to have a low ability to pay. Somewhere along the line hospitals spend \$10 billion a year training people, so there should not be an inability to pay. There's dollars being spent every day, but if you only see one small aspect of the budget you perceive yourself to have very little spending capability. Most educators are not trained as administrators and feel powerless when it comes to major budgeting decisions.

Impact of DRGs. I think the other area that has had a major impact on hospital training is DRGs. When DRG's initially were announced the impact on capital expenditures on hospitals was phenomenal. As a result, hospital accounting systems had to totally change the way they were dealing with all kinds of problems. You went from an educational system that was directly reimbursed to an educational system that really was not even acknowledged within the DRG repayment structure. Now what has happened because of that is that, over the last 3 or 4 years, the really efficient hospitals have survived and the nonefficient hospitals have been absorbed into other hospital chains, have gone out of business, or have merged with other facilities.

The positive impact of DRGs is that now hospitals have much stronger accounting procedures and they understand where their costs are coming from. I think, ultimately, DRGs will be the strongest force to help get technology in education into the marketplace

because there if you can demonstrate cost savings, cost productivity, then you are going to end up benefiting from that.

Problems Related to the Technology

Now in addition to these characteristics of the marketplace you are selling to, let's look at the problems that our products have. One is the high cost of hardware. The average interactive video learning system is running between a low end of about \$6,000, to a high end of \$10,000 to \$12,000. Another major problem is multiple hardware types. There are more hardware configurations than anybody can figure out and that really confuses the buyer--and it confuses the seller, I think, too. Software incompatibility is another problem. Nobody can take their software off the shelf and run it into any one of these systems.

Cost of Marketing

Another issue that we don't like to talk about but you need to be aware of is the high cost of sales. The sales force consumes a considerable resource on the side of the R&D groups that are putting together these programs. A salesman will cost you anywhere from \$40,000 to \$60,000 a year just for his salary and he's going to be doing lots and lots of traveling.

What you may not be aware of is that the sales cycle for capital expenditure in a hospital in the most optimistic situation is going to take 6 months. The average situation is going to be closer to 18 months. The reason for that is that with a \$5,000 to \$10,000 hardware package you are dealing with a capital expenditure so it's got to be put into the budget and getting into that budgetary process and getting the dollars actually spent is a fairly significant cycle to go through. So if you are out there fielding a sales force you can just darn near bet that you are going to be supporting that salesman without any commissions to pay his salary for at least 6 months--and if you are very wise you better figure it's going to be at least a year. That is a lot of money to spend before you ever see you first sale.

Marketing Techniques

Now, putting all that together, what kind of things can we try to recommend to both us in the marketplace as well as to the various hardware vendors and other people? I think, number one, we must demonstrate that we are increasing the trainer productivity. Actronics, whether it meant to or not, was perceived as trying to replace the CPR trainer. That is not a good position to be in. What you want to do is to expand the capability of those people who are doing training to make them more productive so that the same individual can train twice as many people rather than being replaced. The human element is not going to go out of training.

The second important area is to demonstrate a reduction in lost productivity time for employees. We either need to make them get their training on the site so that they are not taken off the job or in some manner reduce the amount of time that is paid for personnel being trained where they are not actually producing for the hospital.

We also need to focus on generic topic areas not to waste our efforts in developing expensive videodisc products that do not meet some kind of generic marketplace. I think because of the not-invented-here syndrome, we had better focus on including op-

tions to tailor these generic programs to the needs of an individual hospital. For instance, on the arrhythmia recognition course we market, you can add or subtract any of the topics that are contained on that program. In the CPR course you can change the local phone number for an emergency to the phone number that's used in your facility. These kinds of tailoring options I think are going to be required to overcome the not-invented-here component.

I think all of our companies need to get together to look at joint marketing opportunities. The individual cost of sales force to each company is outrageous. David Allan has had his experiments with a sales force that was large; I've had my experiments with a large sales force, and they cost of a lot of money. Until we get together and start having joint marketing efforts, none of us are going to enjoy the successes that we'd like to see.

I also think that it's also important we recognize that among all these compatibility issues, that we as vendors are going to have to at least do something to try to support as many of the major hardware configurations in the marketplace. Now that's not going to be all of them because there are 7,000 variations. But you can choose the market leaders and try to do what you can to support them.

Future of Interactive Technology

Now that I've given you all of the recommendations, let me just give you my prediction for what I think is going to happen. I think that none of us is going to do well until some technology like CD-I comes out of the woodwork and addresses the real problem areas. CD-I offers the ability to have low cost, standardized hardware systems. You don't have to worry whether it was built by IBM or whether it was built by DEC or built by Sony. It has one standard configuration and it also has one common software. All software produced for CD-I will run on all CD-I hardware systems. Until you have those kind of situations, low cost standardized hardware and low cost standardized software, the marketplace is never going to even begin to recognize the potential that it has in the medical education field.



Chapter 5

Additional Videodisc Markets

Many opportunities exist for videodisc vendors within the healthcare industry. At the Washington Videodisc Conference, held October 18-21, 1987, three additional videodisc markets were examined: CPR training, occupational health and safety, and dental education and training. In addition, the nursing education market was discussed at the Interactive Healthcare 89 conference, held June 3-6, 1989 in Washington, DC. The following are edited transcripts from those presentations.

Nursing Education: Complex Market with Tremendous Potential,

Christine Bolwell, RN, MSN, Editor/Publisher, Nursing Educators Microworld.

Nurse educators and videodisc developers want to see interactive video become a significant part of nursing education. Both groups must work together to convince hospital administrators and school of nursing administrators that interactive video is a solution to many of their problems. Ultimately, the best way to do this is to demonstrate that interactive video is a cost-effective means of dealing with these problems.

Economic Pressures on Hospitals

The Nursing Shortage. The nursing shortage is widespread and is having a significant impact on hospital budgets. Surveys by the American Hospital Association and others indicate that in 1988, 78 percent of the nation's hospitals reported a shortage of nurses.

Bed Closures. Fewer nurses are available to care for patients, forcing some hospitals to close their emergency rooms and hospital beds. Closure of one hospital bed can result in as much as \$350,000 per year in lost revenues.

Agency RNs. To keep hospital beds open, hospitals are hiring nurses from temporary agencies. The salary for these temporary nurses is twice that of a hospital employed RN.

RN Recruitment. Hospitals are forced to recruit heavily for nurses. According to the 1988 National Association for Health Care Recruitment, 1988 recruitment budgets averaged \$154,000 per hospital – up 35 percent from 1987.

RN Salaries. To attract the best and the brightest nurses, hospitals are increasing nursing salaries. Salary wars in southern California have increased base salaries to be-

tween \$30,000 and \$50,000. With a 20 percent night shift differential, some hospitals are paying night nurses as much as \$60,000 a year.

Cost of Replacement. With RNs constantly being attracted to hospitals with more satisfying work environments, the job turnover rate is between 13 percent and 20 percent per year. Adding together the costs of recruitment, paying temporary nurses, and orientating newly hired nurses, it can cost a hospital \$15,000 to \$20,000 to replace just one RN.

RN Orientation. In many cases, newly hired experienced nurses collect a salary while sitting through an orientation that is only partially relevant to them. Hospital administrators would like to find a way to reduce the cost of orientation programs, which can be as high as \$96,000 per year.

Solutions to Problems Faced by Hospital Administrators

Hospital administrators confronted with these expenditures are looking to increase staff nurse retention and productivity, increase the return on dollars spent for mandatory education, and decrease costly litigation due to on-the-job errors by under trained nurses. The steps many administrators can take are:

Accelerate Orientation. Many hospitals have turned to a competency-based, individualized orientation. The knowledge and skill deficits of each new RN employee are identified and corrected. The program is customized at different levels for experienced RNs, RNs employed to work in a new specialty area, and for recent nursing school graduates.

Cross-Training. Productivity is increased with cross-training, which allows RNs to function safely in more than one area of the hospital. Cross-training also reduces costly mistakes and the possibility of legal action.

Management Skills. Hospitals with the lowest staff turnover are ones which provide a supportive environment, professional growth, and professional recognition. Nurse managers can help create this constructive work environment by applying human resource management skills. Unfortunately, few nurse managers have been formally trained in this area.

Business Skills. Due to recent economic pressures, hospitals increasingly are being managed as a business. Nurses also need to learn essential business skills to manage nursing units efficiently.

Nursing Skills and Competency. Nurses are always in need of updates on new drugs, new equipment, and new procedures. An increasing number of educational programs are mandated by state, federal, and professional organizations.

Reducing Litigation. The threat of litigation is a big economic incentive to providing nurse education that will result in increased patient safety. Two common problem areas are medication errors and patient falls.

Searching for a Training Solution

While all hospital administrators recognize the need for educational programs, the big problem is implementation. When a hospital is short-staffed, it is difficult to schedule time for groups of nurses to listen to educational presentations. In addition, when nurses are being paid \$25 to \$30 an hour, it becomes very costly to place them in lengthy training sessions.

Hospital administrators are looking for educational programs that will reduce the time for learning, obviate the need for removing groups of nurses from a patient unit, promote learning among nurses, and – most important of all – assure learning.

Economic Pressures on Schools of Nursing

Reduced Enrollment. Enrollments in schools of nursing peaked in 1983 and have been on the decline ever since. As enrollments decline, so does the available dollars with which to operate the school. In order to deal with the economic pressures placed upon nursing schools, administrators are forced to find ways to attract larger numbers of qualified students.

Student Recruitment. To increase enrollments, administrators are taking a close look at the populations from which students can be recruited. Because it is a buyer's market, potential students can be selective in choosing a school of nursing.

The best and brightest high school students and second-career students will be attracted to a school with graduates who consistently pass the licensure examination. The thousands of RNs returning to school for a baccalaureate degree will be looking for schools which offer accelerated learning of essentials, a curriculum that is relevant to individual needs, and academic credit for previously acquired nursing knowledge and experience.

Cutting Costs. In addition to stepped-up recruitment efforts, school administrators must find more cost-effective means to accomplish their basic mission – preparing students to pass the RN licensure exam (NCLEX) in preparation to practice nursing.

Maximizing Faculty Expertise. Rather than having faculty spend all their time dispensing basic knowledge, administrators must allow them to teach the more complex skills so important to nursing practice today – decision-making, critical thinking, problem-solving, and retrieving, collecting, analyzing and communicating information.

In view of the economic pressures on schools of nursing, administrators are eager to design a curriculum that will reduce redundancy, increase relevancy, speed the learning of essentials, and maximizes the expertise of their faculty.

Therefore, the driving forces for both hospitals and schools of nursing administrators are solutions that will attract and retain staff nurses and students, accelerate the learning of essentials, and enhance productivity by maximizing human resources.

Attributes of Interactive Video

Reduced Learning Time. Extensive research shows that computerized educational materials result in the same degree of learning as traditional methods, but in one-third to one half the time.

Flexible Access Time. Unlike traditional methods of classroom instruction, computerized education and training programs can be accessed at any time. This is an important attribute for a profession that requires round-the-clock employment. Flexibility in access time is also important for the part-time student. Of the nearly 50,000 RNs enrolled in baccalaureate programs, 70 percent are part-time students.

Flexible Presentation. Unlike traditional methods in which all learners are given the same information, computerized learning materials can be individualized to meet the specific needs of each learner and thus reducing redundancy.

Cost-effective. Many vendors and educators have compared the cost of traditional learning methods with the use of computerized programs and demonstrated substantial fiscal savings with interactive video.

Appeals to Adult Learners. The majority of those who need education and training in nursing today are adult learners. The average age of the two million RNs in clinical practice is 41.5 years old. The average age of the ADN student is 30 years old. The average age of the returning RN student is 31. ADN students and the RN students represent 70% of the nearly 200,000 students enrolled in nursing schools.

Incorporation of Video and Audio. Health care depends greatly upon sight and sound. Nursing students need opportunities to see and hear conditions which can not be represented in textbooks or on computer screens. Interactive video can help students to make clinical assessments, to generate appropriate nursing diagnoses, and to make clinical decisions by allowing them to see and evaluate a patient's color, observe breathing patterns, and hear breath and heart sounds.

Barriers to Implementation

Administrators are not racing out to buy and implement interactive video technology. Although many observers may feel that one barrier to widespread acceptance is cost, in schools of nursing, research has shown the biggest reasons given for the lack of technology is not cost, but a lack of faculty time and skill.

Although the biggest reason given by hospital educators was cost, in that same survey 94 percent of the respondents also reported purchasing videotapes regularly. Videotape also can be an expensive medium, but is widely used because there are hundreds of titles that serve the needs of hospital educators.

Which points out another frequently cited barrier to use of microcomputers in schools and hospitals. The lack of good software, and not the cost of the technology, is the most likely explanation for schools and hospitals not owning and using microcomputer and interactive video technology.

Microcomputer Acquisition

Despite complaints about cost, 71 percent of the schools of nursing and 41 percent of hospital education departments own microcomputers. The growth of computer hardware is clearly related to an increase in available software. The number of nursing software listings for microcomputers increased from 150 in 1985 to nearly 400 in 1989. If the growth in software and in hardware acquisition continues at its present rate, every school of nursing and just about every hospital education department will own and use microcomputers by 1997.

Interactive Video Acquisition

Regarding interactive video, seven percent of the schools of nursing and less than one percent of the hospitals own interactive video hardware. In addition, only 42 interactive videodisc programs even somewhat appropriate for nursing education are available

for purchase. This reflects a hardware and software penetration which is comparable to microcomputer penetration in 1983.

However, when you compare the tremendous needs of nursing education for interactive video technology with the benefits that it offers, it is easy to believe that its growth will at least match the ten percent growth rate of microcomputer acquisition. At that rate, almost all schools of nursing will own interactive video hardware by 1999. In the same year, just over half of the hospital education departments will own interactive video hardware.

Forces Expediting Acquisition

At least five forces are expediting the acquisition of interactive video hardware:

Reduced Technophobia. Because the microcomputer has paved the way, nursing educators, administrators, and students are experiencing a lesser degree of technophobia regarding interactive video technology.

Hardware Placement. It is becoming easier to get hardware into hospitals. A number of groups are either donating interactive video equipment or making it available on loan or at a reduced price.

Establishment of FITNE. The Fuld Institute for Technology in Nursing Education (FITNE) has been single-handedly responsible for installing interactive hardware in 75 schools of nursing (five percent of all schools) in just one year.

Computerized NCLEX-RN. Many schools of nursing will be compelled to integrate interactive video technology because of the development of a computerized examination by the National Council of State Boards of Nursing. Administrators will want to insure that their students are comfortable learning and testing on computerized systems.

Magnetic Pull. The year 2000 itself may accelerate these trends. According to futurist John Naisbitt, there is a psychological fascination with the end of an old and the beginning of a new century. The pull toward the end and beginning of a new millennium is even stronger. Thus, during the next 10 years the pull toward interactive videodisc integration may be irresistible.

The most important forces expediting the integration of interactive video technology are commercial developers—who must work with educators to provide solutions to problems faced by hospital and nursing school administrators—and educators—who must work with commercial developers to convince administrators that videodisc technology is a solution to many of the economic and educational problems they face. By working together, the widespread use of interactive videodisc technology will become a reality before the turn of the century and the new millennium.

Marketing Videodisc Courseware to Non-hospital Environments

Danny Cassidy, Vice Chairman, Actronics, Inc.

When Actronics started distributing learning systems four years ago, our initial marketplace was almost 100 percent hospitals. Today only about 50 percent of our marketplace is hospital sites and the other 50 percent are in the non-hospital market sites. Before we focused on the non-hospital marketplaces we were, like the other videodisc companies, losing boucous [many] dollars every year and had a very dissatisfied group of

stockholders. Since we have diversified and begun to attack the non-hospital marketplace, the number of sales and the profitability of the company have gone completely in the opposite direction.

Non-hospital Training Sites

Let's start by taking a look at locations for health-related training that are non-hospital sites. You have a large number of companies--utilities, mining, airlines, trucking, a number of defense contractors--where OSHA (Occupational Safety and Health Administration) has mandated certain healthcare training. It may be first aid or safety on the job, it may be CPR, or how to deal with hazardous materials. In each case, OSHA has mandated certain training and as a consequence at least 20,000 locations have 500 or more employees who need some type of mandated health-related training.

In addition to those 20,000 locations, which is already larger now than the hospital market, you have another 10,000 locations that deal with emergency medical services. And so from the standpoint of almost anything that has to do with burn care, pediatric care, acute medical interventions, acute therapeutic interventions for trauma, any of a number of areas, you have a ready built-in marketplace of individuals who need this type of medical training. Let's not forget about the military. Military medics are located all across the world and virtually every Army, Navy, Air Force or Marines base has got a medic corp that has to have some type of ongoing training.

In addition, you have another group which may be even larger than all of these previous groups put together, and that is industry itself. Companies like Lockheed and GM have all demonstrated that they can save money through health promotion and improved health risk management. It has been shown that by providing health-related training to their employees, these companies save innumerable dollars a year from a reduced amount of sick leave, reduced mortality and morbidity, and generally more productive employees.

Positive Features of the Non-hospital Market

I can't give you a dollar value of the non-hospital marketplace with a high degree of certainty, but I think, conservatively, you're talking about a minimum \$25 billion dollar a year market--and it could easily exceed \$150 billion dollars a year. It's got some very nice positive features. It has an excellent ability to pay. If you are going to be spending those dollars anyway because of your employee healthcare costs, and now you can reduce the total dollars you spend by investing in training, you can pay the dollars. Unlike hospitals, these people tend to have centralized education departments. You have one medical director who sits down and decides all the healthcare training needs, defines those, has an idea of what it's costing him to implement it.

Industry is very good for knowing exactly how many dollars they're losing when an employee goes to a two-hour training seminar and knowing exactly how many dollars it costs him to have that trainer on staff and what that trainer was paid, and what the capital equipment expenditures were. Therefore, when you talk to them about dollar savings, they have realistic backgrounds both to understand the dollars that they are saving and to see where they come on their bottom-line budgets.

One area that caused our company to migrate into the non-healthcare marketplace, though, is the fact that these people are not experts in healthcare. The not-invented-here syndrome does not operate in a business environment. As a matter of fact, the business people are saying they don't want to make medical decisions. They are looking to outside medical experts to make those decisions for them, to give them the guidelines, and to provide the programs for them as a part of their risk management.

Negative Features of the Non-hospital Market

There are a couple of problems in the non-hospital marketplace. One of them is that for a given product--and we could take any one but just assume we took CPR--there are tremendous numbers of vertical marketplaces that one could be dealing with. The transportation market where CPR training might be needed includes trains, airlines, bus personnel, ambulances, and heavy industry. Therefore, you have a large number of totally unrelated groups that need CPR training.

Everybody in the utility industry needs CPR training, and everybody in the mining industry. The number of different marketplaces that you have to understand to go in and sell your products is very, very diffuse. These industries break up into a wide number of market areas and to be effective you have to understand each vertical market, whether it be transportation, utilities, manufacturing, or whatever.

I think the other thing that is a potential negative from the standpoint of people who are interested in producing health-related products, is that the number of healthcare topics is rather limited compared to the hospital market. Topics such as first aid training, CPR, nutrition, hypertension, diabetes, alcohol abuse, and smoking cessation will be of importance, but once you get outside of the basic areas, there are no untapped areas for you to continue applications development. In other words, in this marketplace it is going to be more important to define a topic area and then expand the vertical marketplace.

I think because of the complications of these markets, the fact that you are dealing with marketplaces that are somewhat more vertically segmented, it would be useful to try to develop an alliance with somebody who is already in that training industry. If you work your products with somebody who already is selling into the marketplace that you are attacking, say they are already selling training or they are already selling videotapes, then that sales force is already being supported and your products become nice add-on items. They don't become the entire sales force support. I think this can be very beneficial in terms of long term market development.

Worker Training & Communications: The Impact of Government Mandates

Pamela Van Wagenen, Vice President, Interactive Medical Communications, Inc.

Today worker training and communications have become critical issues in American industry, particularly in healthcare. This is because of several factors: 1) the broadening regulation from the Occupational Health and Safety Administration (OSHA) and other government entities, 2) increased employee awareness of workplace hazards, 3) both the real and imagined threat of bloodborne diseases, especially AIDS, and 4) increased employer awareness of worker's rights, their own liability and, more important, their growing appreciation of the short- and long-term benefits of effective training in education.

Influence of OSHA Training Mandates

First, let's look at OSHA and some specific examples of the legislative enthusiasm and power behind the growing concern about workplace safety. Since OSHA's creation in 1970, its purposes and goals have been fraught with controversy, with problems of inadequate staff and budget, bureaucratic inertia, or at best an ambivalent approach to formulating and implementing basic health and safety regulations in the workplace. However, it's heartening to know that progress is at last being made, albeit slowly.

In 1985, OSHA issued the Hazard Communication Standard granting 14 million workers in the manufacturing and chemical industries a fundamental right, the right to know about the potential hazards of the chemicals they work with and the right to know how to work with them safely. The standard required companies to develop proactive health and safety policies and programs and mandated training for affected employees. This training is to take place before the worker is assigned initially and every time a new chemical or a new hazard is introduced into his environment.

Now, what should have followed quickly but didn't until last August after continuing pressure from unions and workers and ultimately an order from the Third Circuit Court of Appeals, OSHA has expanded the Right to Know Regulation to cover virtually every worker in the country who may reasonably be expected to be exposed to a chemical hazard on the job. Effective May 1988, an additional 18.5 million workers will be granted this basic safeguard relating to chemical hazards. This includes workers in construction, transportation, agricultural industries, wholesale and retail trade services, as well as all facets of healthcare. Healthcare workers, professional and non-professional, represent a number of the new population covered by this expanded standard, some 5.5 million in all.

In addition, OSHA announced recently that it would also enforce guidelines in the healthcare industry for controlling the transmission of bloodborne diseases, principally hepatitis-B and AIDS. It appears that OSHA finally succumbed to the relentless lobbying of nursing organizations and hospital workers and services unions and has asserted its authority in this very important area. In the short term, OSHA is enforcing the guidelines developed by the Centers for Disease Control under the authority of the General Duty Clause of the OSHA act of 1970. The General Duty Clause states that each employer shall provide his employees a place of employment which is free of recognized hazards that are likely to cause his death or serious injury or harm. The guidelines require healthcare employers to provide all at-risk employees with information and training about the epidemiology of AIDS, hepatitis B and other bloodborne diseases and to provide protective equipment, vaccines and more. Until now, compliance with the CDC guidelines has been voluntary and far from universal. For the long term, OSHA is promulgating more specific regulations controlling bloodborne diseases.

High Risk Notification Act

In another light, industry and labor are anxiously watching as demand swells for passage of pending legislation known as the High Risk Notification Act. This bill designates some chemicals as highly toxic and requires that workers be told that they are at risk for specific diseases and to what degree exposure to that toxic material may result in disability or death. It encourages workers to enter into programs of medical monitoring and counselling, the initial stages of which are to be paid for by the employer or the for-

mer employer. It is highly likely that the legislation will pass in some form, and it will have application in the healthcare sector as well.

Last year, OSHA was again pushed, this time by Congress, to develop regulations protecting more than 170,000 workers at toxic waste sites. The rules require a periodic medical examination and a minimum of 40 hours of health and safety training for workers at cleanup sites and at currently operating dumps that handle hazardous waste. Though mandating 40 hours of training may not guarantee that that training will be effective, OSHA is making it quite clear that it is taking training seriously. Throwing a bunch of people in a cafeteria, showing them a videotape or talking at them isn't going to qualify as compliance. The training provision of the original and expanded Hazard Communication Standard also illustrates OSHA's support for comprehensive training. The standard requires that specific training be given regarding the physical and health hazards of materials that employees work with on the job, the symptoms of acute and chronic exposure to these materials, methods for identifying hazards associated with these materials and protective equipment and measures required to control exposure in the normal and under emergency situations.

Stepped-up Enforcement by OSHA

All in all, a terrific burden is being placed on employers, especially in healthcare, as legislation regulating safety in the workplace proliferates, and it appears that OSHA is beginning to take training and other violations seriously as well. For instance, when OSHA recently fined a major fabric company almost half a million dollars charging that it had violated more than 200 rules for protecting workers who handle hazardous chemicals, it cited lack of training as a major overall reason. Union Carbide agreed in July to pay more than half a million dollars in penalties because it violated training recordkeeping provisions in hundreds of instances. Some further evidence of OSHA's growing willingness to flex its regulatory muscle in this area is offered by the following.

According to an OSHA spokesperson quoted in the American Dental Association News, healthcare employers who do not comply with the CDC guidelines for bloodborne diseases will be subject to penalties of up to \$10,000 per violation, and he warns that even private practice dentists and doctors with one or two employees will be subject to these fines.

Finally, according to a special assistant to regulatory affairs at OSHA, OSHA will notify healthcare employers in writing of their obligation to follow CDC guidelines. This letter will emphasize that health professionals can decide how they wish to train their employees and will advise these professionals of the liability of not complying. Similarly, but more important, a letter outlining employee rights and employer obligations will be sent to more than 10 million healthcare workers and emergency service personnel, an action that is sure to stimulate worker concern and demand for effective training and protection.

Cost Considerations

In this era of cost containment and the almighty bottom line, how are we going to meet these massive training needs? According to OSHA, the expanded Right to Know Regulations to be implemented over the next 9 months, will cost industry \$687 million to implement in the first year with estimates as high as \$200 million a year to *maintain there-*

after. However, looking at the next 40 years, savings generated by reducing illness and injuries hold a promise to make the effort and expense worthwhile. OSHA predicts that the revised standard will mean a 20 percent reduction in the number of chemically related injuries, illnesses and deaths in the nonmanufacturing workplace alone.

And what about AIDS. A reduction in the spread of AIDS brought about by effective education and training could save millions of dollars and many thousands of lives. According to a report in the New York State Journal of Medicine, as of March 1987 approximately 31,000 Americans were diagnosed as having AIDS. That number will increase to 270,000 by 1991, with 170,000 deaths attributable to AIDS by the year 2000, and the CDC estimates that for every AIDS patient who is diagnosed there are 50 undiagnosed carriers who are not known to us yet. I was not able to find precise figures on the cost of caring for these victims from diagnosis to death but to give you some idea of the magnitude, it is estimated that by 1991 the cost of treating AIDS victims in New York city hospitals alone will reach \$1 billion.

Challenges to the Training Industry

So we see that the imperative to develop effective education and training programs is supported by regulatory action, by the need to reduce the cost to industry and to society of occupationally induced illnesses, and the moral obligation to prevent needless human suffering. If we are going to achieve these economic and moral goals, then we must overcome many educational and financial barriers. Let's look for a moment at some of the educational challenges.

First, the population covered by workplace training standards represents virtually the whole spectrum of learning styles and attitudes and education and aptitudes. It includes the functionally illiterate, the learning disabled and the gifted. It encompasses every ethnic, sex and many age groups.

Second, the subject areas to be dealt with involve scientifically complex concepts and a long measure of scientific uncertainty. They require that we impart an understanding of the relative nature of risks, a task that is difficult when we must deal with emotionally loaded subjects such as cancer, reproductive damage or personal sexual practices. Lest we think that the problem of teaching the concepts of relative risk is confined to those with lesser education, we have only to look at the recent statement by Surgeon General C. Everett Koop in which he criticized the growing number of healthcare professionals, including physicians, who are today refusing to treat AIDS patients.

Third, since the sheer number of people who must receive some type of work-related training in safety and health is so great and the large majority of these learners are adults, we need a flexible training delivery system that is nonthreatening, effective and widely available. Finally, since the information to be conveyed is of such a critical nature and is also mandated by law, we need a training approach that can ensure and verify understanding and document that training has indeed taken place.

The Solution: Interactive Videodisc

In my opinion, interactive laserdisc technology is the only viable long-term solution to the problems of providing effective and affordable health and safety training and education for the masses. The use of the technology to date in general industry offers an exam-

ple for the healthcare sector to follow. As a principle at Interactive Medical Communications, I have played a role in developing laserdisc courseware that is being used to train over 400,000 United Auto Workers at General Motors and another 40,000 workers at the New York City Transit Authority to work with chemicals safely. And I should add that both the unions and management are extremely pleased with these programs as are the workers.

There are numerous other programs, some of which you have heard talked about today, studies and case histories that document the learning effectiveness and cost efficiency of this technology. Let me quickly cite a few of them for those of you who may be new to the industry. IBM conducted a study through its Corporate Management Development Center which confirmed that interactive videodisc programs used in a one-on-one teaching situation increased student mastery of information by 300 percent and increased learning speed by 25 percent. IBM also looked at the comparative cost of learning delivery methods and found that a day of interactive training on site cost \$50 per student compared to \$150 per day for classroom education within commuting distance of the workplace and \$300 per day for classroom education at a centralized facility.

The New York Transit Authority, which utilizes a combination of mobile and stationary training centers, estimates they have reduced the time it takes to do chemical hazard training by 70 percent. Finally, I have been told by a reliable source that a number of insurance companies have been convinced to lower their premiums by 30 percent to bar owners whose employees undergo interactive training to learn how to recognize and deal with intoxicated customers or those who are in danger of becoming intoxicated.

Conclusions

But the question still arises, how can we afford to develop interactive programs? My response is, how can we afford not to? If we think about it, there are abundant funds available. President Reagan's budget for 1988 provides \$100 million for general AIDS education and \$55 million for programs directed to intravenous drug users. That could buy a lot of good courseware and a lot of hardware as well. In addition, there are millions of dollars in grants and monies available through the NIH, the CDC, the Department of Labor and various state and private organizations. Pharmaceutical companies spend millions a year on professional and patient education programs that could be channeled into interactive program development, and every hospital, academic institution and corporation spends monies to produce essentially duplicative programs.

Perhaps the risk managers may well prove to be allies in the cause of funding meaningful programs in this area. According to a lawyer expert in OSHA and related matters, insurance companies are writing exclusions into their policies that deny payments to employers who are not in compliance with State and Federal regulations. And you may find management more open to the need for effective health and safety programs if they realize that employers and corporate executives are being held liable in criminal and civil cases for health and safety violations, not merely being slapped on the hand by OSHA and fined a minimal amount of money.

I think, finally, it's important that we begin to put aside our individual and institutional egos and start finding more creative ways to pool our resources through industry associations, hospital associations, professional societies and professional healthcare or-

ganizations. We need to look for ways to structure deals between private companies and these groups to the profit of all concerned. We need to do this because health and safety training needs are great and won't ever be effectively addressed with a few videotapes, pamphlets and 30-second public service announcements.

We are going to have to spend money on these programs anyway. The government has made that clear. As I see it, we can either pool those funds, develop effective programs that will reap benefits for all of us in the long run or we can invest our individual monies on ineffective solutions and lose both money and human lives in the short term and in the long term.

Finally, these areas of mandated OSHA training may well be the entree for videodisc into the hospital and healthcare market that we have all been waiting for. Mandated training, particularly hazard communication and bloodborne diseases, affects all employees, nonprofessional and professional alike, and they are the most likely arenas in which we can prove the learning and cost effectiveness of this technology. Once the technology is in place, it will be easier to justify the cost of other programs for medical personnel and ultimately for patient education, and it is patient education where I think the true impact of videodisc technology on total healthcare costs will be the greatest--but that's next year's presentation.

Dentistry: An Un-tapped Market

Stephen W. Smith, President, Dental Service & Information Corporation

What is a "non-hospital" environment and which such environments are prospects for videodisc technology? I consider non-hospital environments as most out-patient forms of healthcare that normally operate independently of a hospital. Dentistry and in-home healthcare are both examples of such non-hospital environments that offer unparalleled opportunities for the videodisc entrepreneur.

When the topic of dentistry is brought up, most of us think about our family dentist. One does not think of dentistry as "big business." Wrong! In 1986 the dental industry was a 32 billion dollar industry, and by 1990 it is expected to surge to over 40 billion dollars. By 1990 dental care is projected to account for over 13 percent of our nation's healthcare expenditures. Even though dental decay is on the decrease, visits to the dentist are increasing dramatically. Every day, over one million people visit their family dentist.

To understand the potential of dentistry as a videodisc market, one must first realize that there are over 127,000 free-standing, for-profit, dental offices in the country. This figure does not include dental schools or government affiliated dental clinics. These free-standing, independent dentists are all small businesses who must compete in the healthcare environment of today. In 1985 these small businesses averaged more than \$202,000 each in patient revenues and spent over \$15,000 each on dental equipment and supplies. The typical dental office houses over \$100,000 of technical equipment, and few of these pieces have the potential to produce as much income as interactive videodisc systems.

The Cost Factor

The cost of interactive hardware systems is within the reach of the average dentist. However, dentistry is part of the healthcare system and, as such, is under pressure to con-

tain costs and improve productivity. It is these pressures to contain costs and compete for patients that are opening doors for interactive videodisc technology and similar outpatient healthcare services.

In order to place this technology in the dental market, we need to provide a cure for some of the "toothaches" of dentistry.

Toothache Number 1: Staff Training. OSHA now mandates the training of healthcare workers to assure their health and safety. The OSHA requirement will force the dental industry to use some type of in-house training that, because of the litigious nature of healthcare, provides documentation of learner participation and comprehension. Interactive videodisc is a good choice to meet this training requirement.

Toothache Number 2: Increased Revenues and Improved Productivity. The establishment of interactive videodisc systems for mandated training opens the way for other videodisc courseware. Dental offices require training in basic office skills, dental assisting, X-ray technology, and infection control procedures. Today's family dentist must also begin to market additional, profit-making services to survive. Again, interactive videodisc is the logical choice to train auxiliary personnel and market profit-generating services to the dental consumer.

Toothache Number 3: Keeping Up With New Technologies and Associated Training. It is very expensive to market new products to the dental profession. An interactive videodisc system in a dental facility provides a direct link to the dental purchaser. The interactive videodisc can sell the product to the dentist, teach the staff how to use the product, and market the product or service to the dental patient.



Chapter 6

Commercial Ventures

1988-1989 seems to have been a growth period for commercial videodisc development, doubling the number of vendors who have a health-related project to offer. With this growth there also seems to be some hardware stability with the IBM InfoWindow system.

New Trends in Hardware

There finally seems to be a "shakedown" in the industry regarding hardware systems. Vendors today are going one of two routes: market their programs on a inexpensive, custom-built, dedicated videodisc system, or on one or more of the standard integrated systems such as the IBM InfoWindow or Sony View system. A few vendors are doing both.

In the past, hardware systems have been one of the biggest problems for the software vendors to deal with. Compatibility was a concern because buyers hesitated to purchase a non-standard system on which they would not be able to play other commercial programs. Today, this problem is being taken care of by the emergence of a few dominant systems and the willingness of most software vendors to adapt their programs for several configurations.

Integrated Hardware Systems

Integrated systems are hardware units where all components are sold together as a package: computer, videodisc player, monitor, graphic overlay, touchscreen, etc. Two main advantages of this type of system is assurance that all components will work together and the fact that there is only one dealer to call if anything fails to operate.

Until the introduction of the IBM InfoWindow, there was no standard hardware configuration in the industry. Now it appears that the InfoWindow is quickly becoming the standard, with other configurations keeping a few specialized industry niches. As evidence of this trend, of 72 Level III commercial programs listed in the 1989 *MedicalDisc Directory* (Stewart Publishing, Inc.), all but four played on an InfoWindow or compatible system. The four which played only on a proprietary system were developed by Actronics for their CPR Learning System. Many of the InfoWindow-compatible programs also were programmed to play on various other configurations, but no one system is as universally accepted as the InfoWindow.

Commercial Programs Listed in the 1989 MedicalDisc Directory

Type of System	Number of Programs
InfoWindow-compatible	68
Actronics	4
Two-screen PC	5
Two-screen Macintosh	0
Level II	6
Level I	11
Total	94

Two-screen Systems

Although the InfoWindow is the leading system for "off-the-shelf" courseware, the type of delivery systems used in the healthcare market will vary according to subject matter and setting. In some of the medical specialties which have large collections of still images (radiology, pathology, hematology), two-screen systems, costing as little as \$1,500, may remain in favor for some time. In these disciplines, users are content to have the medical image appear on one screen while descriptive text and graphics appear on the computer screen. For most applications, there is no need for graphic overlay, touchscreen, or other features offered by the more expensive InfoWindow platform.

Level One Systems

Many commercial applications are presented on Level One videodisc systems. The successful RAVEN system for ophthalmology patient education was an inexpensive, practical combination of hardware and software which used a customized keypad to access one or more of 28 different video segments. The newest variation of Level One delivery is the laser barcode reader, available in the past, but recently made more accessible by Pioneer Communications. The first health-related commercial application using this technology has been produced by the American College of Radiology (ACR). The ACR is producing a series of videodiscs which are accompanied by a barcoded workbook and scanning wand, eliminating the need for even a computer. The total cost of a Pioneer LD-V2200 videodisc player and scanning wand, and is less than \$1,000.

Companies & Products

Actronics, Inc.

Actronics was the first commercial company to be formed for the purpose of developing and marketing health-related videodisc programs. Under license to the American Heart Association, Actronics was formed in 1983 to market the well-known CPR system developed by David Hon when he was National Training Manager at the AHA.

The CPR/ACLS Learning System consists of an Apple IIe computer, Sony or Pioneer videodisc player, a random-access audio cassette player, and electronic manikins

which are interfaced with the computer. This dedicated system sells for \$12,895, with programs ranging in cost from \$8500 for *CPR* to \$995 for *AIDS Information*.

Sales of the CPR/ACLS Learning System have reached approximately 300 units at 250 locations, with sales being slowed by problems common to all videodisc hardware vendors. However, Actronics Vice Chairman Danny Cassidy, M.D., reports that sales have increased recently as the result of new marketing efforts outside the hospital community. Apparently, many of the barriers to sales found in hospitals do not exist in corporate and industry settings. See Chapters 4 and 5 for more detail.

How The System Works

The program presents "classroom" material using the videodisc player and audiocassette player. Using a light pen, learners can evaluate their progress by taking short quizzes at the end of each section. Based upon this evaluation, appropriate video segments are selected by the student to provide review sequences and more in-depth instruction. At all times, the program provides continuous and immediate feedback.

Most impressive is the ability of the system to monitor the learner's actions using one of the CPR manikins. The manikins are equipped with sensors and activators to provide feedback to the student and monitor performance on all components of CPR procedures, including pulse check, call for help, chest compressions, back blows, ventilations, open airway, etc. As with the live instruction, the program will provide on-going feedback while the student works with the manikin. The System will "coach" the learner by 1) producing audio tones to indicate proper timing of each compression and 2) displaying a graphic summary on the monitor which details the learners overall performance. During practice, the student's performance on the manikin is immediately evaluated by the computer, which, if needed, selects the appropriate coaching responses from the videodisc.

At the end of the lesson material and practice sessions, the learners are able to test their knowledge of CPR using the manikin. Performance standards are based on the AMA's standards and guidelines for CPR. Without the assistance of a live instructor, learners are able to certify at both the Heartsaver and Basic Rescuer levels and receive the AHA Certification Card.

Arrhythmia Recognition

Using the same Learning System hardware, Actronics continues producing continuing education programs for the American Heart Association. The next program developed was *Arrhythmia Recognition*, the first in a series of videodiscs designed to teach the Advanced Cardiac Life Support course offered by the AHA.

The Arrhythmia program provides a complete learning experience in arrhythmia recognition based on the AHA's *Textbook of Advanced Cardiac Life Support*. The program is divided into background lessons, specific lessons on arrhythmia and ECG monitoring, and practice and test sessions in static and dynamic arrhythmias and therapeutic modalities.

Using the large storage capacity of the videodisc, a comprehensive set of ECG's with different versions of each arrhythmia is contained in the program. To insure comprehensive learning and retention, the *Arrhythmia Recognition* program combines ECG pattern and explicit medical drawings to highlight a multitude of arrhythmia variations. Refer-

ence Banks on drugs, algorithms, and arrhythmias are also available to the student at any time during the program.

Airway Management

The third program developed by Actronics, and the second in the ACLS series, is the *Airway Management* program. The purpose of the program is to provide education and training in airway management and airway adjuncts individually or within the context of an ACLS course.

After presenting a comprehensive course overview, the program contains individual lessons to examine the specific elements of airway management, from respiratory assessment to transtracheal catheter ventilation and cricothyrotomy. Learners have the opportunity to practice procedures and insertion techniques using an electronic intubation head, which senses correct placement and effective ventilations. Reference Banks include vocabulary and respiratory anatomy.

Megacode

The latest program released by Actronics is *Megacode*, which consists of three didactic lessons and an interactive video simulation. The lessons are titled "ACLS in Perspective," "Acute Myocardial Infarction," and "Putting It All Together."

When students enter the simulation portion of the course, they play the role of the team leader and are each given 25 minutes to treat a cardiac emergency. They are presented with a patient and are given a description of the patient's history, symptoms, and present condition. The student then begins to interact with his team members who appear on the video screen before him. *Megacode* actually requires students to speak to their team leader, asking for direction and responding to each decision the leader makes. The patient condition likewise responds to those decisions. At any time, random complications may present themselves for the student to recognize and correct.

Upon approval by the American Heart Association, students will be able to test and certify in *Megacode* using the simulation portion of the course. However, students also have the option to practice, rather than test, in the simulation. If a student chooses to practice, he is provided prompt remedial instruction for any error that is made. This feature allows students to gain practical experience and confidence before testing. Because of the random presentation of patients, problems, and other factors, each student receives a different variation of a cardiac emergency to treat. This prevents students from memorizing a scenario and allows for accurate, objective evaluation of each performance.

Circulatory Adjuncts and Resuscitation Pharmacology

The *Circulatory Adjuncts and Resuscitation Pharmacology* interactive video course has been developed in accordance with the standards and guidelines of the American Heart Association (AHA), and is approved for training and testing by the AHA's Emergency Cardiac Care Subcommittee. *Circulatory Adjuncts and Resuscitation Pharmacology* contains four core lessons and provides students with the opportunity to take the ACLS Written Post-Test in a computer-assisted format. *Electrical Therapy* presents information on how defibrillators work, and what factors increase or decrease the probability of successful conversion. It also discusses the energy requirements for both the adult

and pediatric patients, and provides demonstrations of techniques for defibrillation and urgent synchronized cardioversion. Recommendations for the care and maintenance of defibrillators are discussed, along with special situations such as defibrillating a patient with a permanent pacemaker. The Electrical Therapy lesson also contains an overview of emergency cardiac pacing, and instructions on how to deliver a precordial thump. *Intravenous Techniques* provides information on various types of IV cannulas and catheters, and discusses indications for establishing IV access. It also provides information regarding the common principles, advantages, disadvantages and complications of IV techniques. The peripheral and central techniques demonstrated in this lesson include the arm and leg, external jugular, femoral, internal jugular, and subclavian vein techniques. *Cardiovascular Pharmacology* discusses the medications commonly used during cardiac arrest, and those used to control cardiac arrhythmias. It also provides information on pharmacotherapeutic objectives, and discusses the medications used to treat congestive heart failure, hypotension, hypertension, and cardiogenic shock. *Infants/Children and Special Situations* provides an overview and discusses the management of respiratory failure and shock. It also covers devices and techniques used to oxygenate and ventilate pediatric patients, as well as the treatment of life-threatening arrhythmias that may occur in these patients. Post-resuscitation management is also presented, along with information on accidental electrocution, near drowning and circulatory and pharmacological support.

Expanding Courseware Selection

Additional programs being developed by Actronics for the ACLS series include *Adjuncts*, *Pharmacology*, and *ACLS Test Disc*. However, in order to expand the selection of courseware available on their dedicated system, Actronics has begun adapting other commercial programs to play on the Learning System. Acquisitions include several programs originally produced by Health EduTech of Minneapolis, Minnesota. Titles include *Infection Control*, *Electrical Safety*, *Fire Safety*, *Back Safety*, *AIDS Information*, and *Sexually Transmitted Diseases*.

ALIVE

The Applied Learning by Interactive Video Education Center (ALIVE) started out in 1985 as "a consortium of industrial, educational, and professional organizations, associations and individuals dedicated to the utilization of laser storage and video imagery." Based in Akron, Ohio, the Center obtained enough funding to produce an interactive videodisc titled *The Active Knee*. The production was done in collaboration with the Sandy Corporation and is the first of a series ALIVE hopes to produce.

The Active Knee is designed for coaches, trainers, sports supervisors, and medical personnel who will come in contact with an athlete immediately following a sports injury to the knee. What the viewer learns from the program is three-fold: 1) to ascertain susceptibility to knee injuries through pre-screening, 2) to prevent further complications to an injured knee through correct diagnosis, and 3) to conduct a complete post-injury evaluation to determine the degree of injury.

What the Program Does

The Active Knee is a two-sided disc, divided into five modules. Module I presents functional anatomy, addressing bones, major ligaments, main muscle groups, and the specific forces that can damage these structures. Module II covers a systematic process for conducting preseason screening exams so the learner can determine which athletes and active people may be predisposed to knee injury. Module IV provides complete procedures for conducting off-site, comprehensive, systematic knee exams. Module V presents detailed applications, using specific case histories.

The Active Knee plays on most major hardware systems, including the IBM InfoWindow, Sony View, and Visage system, and has been accredited two hours of continuing education units from the National Athletic Trainers Association (NATA). The program originally sold for \$2975, but has recently been divided into 10 component parts, each now sold for between \$595 and \$995. The entire package is available for \$7995.

Natural Knee

A second program developed by ALIVE is the *Natural Knee*. It is based on a linear videotape produced by Intermedics Orthopedics on natural knee implant procedures. By watching the procedure along with enhanced graphic overlays and computer branching, the physician can learn the surgical implant procedure. The program is also used to train Intermedics sales representatives.

Preventative Cardiology

The ALIVE Center also is marketing a two-disc interactive videodisc program *Preventative Cardiology*, produced in conjunction with the Case Western Reserve University's School of Medicine. The program consists of two parts. Part I, geared for pediatricians and physicians, is designed to familiarize doctors with the procedures for distributing cardiovascular disease prevention information throughout their communities. It includes early detection and early intervention strategies for detecting and controlling arteriosclerosis.

The programs are designed to assist physicians in their discussions with patients about sensitive issues such as diet, exercise, and the risks of cigarette smoking. Interactive videodisc allows the physician to learn and practice Strategic Interview Skills. Through evaluation of doctor-patient dialogs, the physician learns how to encourage healthy behavior in his patients.

Part II is intended for doctors, patients, and students (junior high school level and above). It provides an overview of the heart and its relationship to the circulatory system, and it examines cardiovascular disease and coronary heart disease. The introduction covers basic information on the heart, the circulatory system, and arteriosclerosis, while three lessons zero in on effective means of combating coronary artery disease: exercise, nutrition, and not smoking.

American Journal of Nursing

The American Journal of Nursing Company (AJN) is the largest nursing communications company, publishers of seven professional journals. The company also provides educational material for nurses and other health professionals through its Educational Ser-

vices Division and Professional Seminars Division, including multi-media instruction, videotape distribution, inservice education via satellite, seminars and conferences, and a highly successful review course for students preparing for the nursing licensure examination.

The Elderly Patient with COPD

In the fall of 1988, the AJN released the first in a series of interactive videodiscs they are developing for nursing education. The first program is titled *The Elderly Patient with Chronic Obstructive Pulmonary Disease*. The content will focus on key clinical and decision-making skills. The AJN is now reviewing the final script for the disc, with video production beginning in April.

The program is being underwritten with a three-year Special Projects grant from the Nursing Education Branch, Division of Nursing, Public Health Service, Department of Health and Human Services. A significant aspect of the grant is the fact that it not only provides for the *development* of interactive videodiscs, but allows for the *evaluation* of this newest advance in computer-based education, and for the *dissemination* of the results to the nursing community.

Nursing Care of the Elderly Patient

The second program released by AJN is *Nursing Care of Elderly Patients with Acute Cardiac Disorders*. The program is a Level Three interactive case study simulation about two patients: 1) a 73-year-old man who has a myocardial infarction is treated with thrombolytic therapy, then develops ventricular fibrillation requiring defibrillation, and 2) an 80-year-old man with congestive heart failure who develops atrial fibrillation and requires cardioversion.

Users manage the care of these patients by selecting from assessment and intervention screens as they progress through the case study. The choices on these screens are always the same, but the user must select only those which are appropriate at that point in the patient's care. Users have the opportunity to: request assessment data in order of importance, analyze ECG rhythms on a cardiac monitor and 12-lead ECG, interview the patient, regulate fluids and oxygen therapy, select appropriate medications, evaluate lab results, initiate emergency interventions, and set defibrillator for cardioversion and defibrillation.

Users can request information at any time from a library which is filled with information related to the program. They also can obtain definitions of terms by touching the word on the screen. An experienced nurse provides feedback and rationale for appropriate assessments and interventions, focusing on information about care of elderly cardiac patients. Learners are scored on their performance and compared to the score of an experienced practitioner.

Applied Interactive Technologies

Applied Interactive Technologies, Inc. (AIT) of Jackson, Mississippi has also developed and is marketing a proprietary videodisc hardware system which makes use of a cartridge rather than a floppy diskette. The Interactive Video Machine (IVM) sells for \$1500 and consists of a modified Pioneer LD-V4200 videodisc player and a customized compact

keyboard/microprocessor with operating system and control logic developed by AIT. A monitor and other peripherals are available at additional cost.

AIT has converted a number of existing videodisc programs to operate on both their IVM system and on InfoWindow-compatible systems. Each program sells for \$750 and comes with a printed workbook and the necessary program cartridges. The programs include the following titles:

Converted from Health Edutech: AIDS Information Program, Sexually Transmitted Diseases, Health Hazards in Healthcare, Electrical Safety, Fire Safety, Back Safety, and Infection Control

Converted from the Children's Medical Services, Florida: Human Genetics for Nurses, Comprehensive Case Management of Spina Bifida, Case Management of Cleft Lip and Palate, Renal Analysis, Grieving Clients & Families, Intervention in Child Abuse and Neglect, Pediatric Hematology, Pediatric Cardiovascular Defects, and Court Testimony and Documentation.

Converted from County College of Morris: Nursing Decisions for Postoperative Patients.

Converted from Bloomsburg University: Poison Prevention, Military Anti-Shock Trou-sers, and Crisis Management of the Ventilated Patient.

Converted from Alberta Vocational Centre: Urinary Catherization and Sterile Techniques at the Bedside.

Converted from Pitt County Memorial Hospital: Wound Care for Nurses.

Argosy Network Corporation

The Argosy Network Corporation was formed in 1987 as part of a new business development project for a major telecommunications manufacturing company. When the company later decided that the project did not fit with their primary mission, Kent Simpkins, a consultant to the project, secured the rights to the project, name, and logo. Simpkins incorporated Argosy in the State of Tennessee in August 1988.

Argosy plans to deploy a network of interactive video learning stations in hospitals throughout the United States. The Network will offer medical manufacturers and pharmaceutical companies an innovative media opportunity for product marketing, inservice training, and new product introductions by sponsoring courses on the Network.

On-line Interactive Network. The Network is built around a proprietary hardware system which will be installed in hospitals and fed via telephone lines from the Argosy office in Nashville. The delivery system consists of a computer, videodisc player, and touchscreen monitor. The videodiscs will be located in the hospitals, but because the control software is delivered on-line from Argosy, hospitals will pay a fee each time a course is used.

Users of the Argosy learning stations are presented with a menu of available courses. Using the touchscreen, they select the desired course. At appropriate points, the course will stop for query. Users can interact with the course and receive hands-on instruction and simulate real-world situations.

When a course is completed, the user's record is stored. The record may contain the user's name, date, time, responses to questions, score, or any comments the student

may have about the manufacturer's product. The data is then collected by the Argosy computer network and reported back to the courseware sponsors and the user hospitals. This provides the essential feedback and record-keeping that is so important to the hospital, medical manufacturers, and pharmaceutical companies.

Argosy Network Corporation has begun to deploy the first phase of its network in 10 hospitals nationwide during a testing phase that will be completed at end of 1989. This phase will feature the following courseware: *Right Upper and Middle Lobectomy* developed by U.S. Surgical and Health Edutech programs *Back Safety*, *Electrical Safety*, and *Fire Safety*. Plans call for growth to 300 hospitals by the end of 1990 with a substantial increase in courseware from manufacturers and pharmaceutical companies.

Edudisc

Edudisc, Inc. of Nashville, Tennessee is marketing a number of interactive videodisc programs for the Macintosh computer. All of the programs were developed by Bloomsburg University using the Edudisc Mentor/MacVideo authoring software. The programs operate on Macintosh computers with Pioneer, Sony, and Panasonic videodisc players. All programs sell for \$695.

Introduction to Case Studies in Hematology. A series of 20 case studies designed to acquaint users with basic problem-solving techniques involving cell identification and clinical correlations. It presents signs, symptoms, and laboratory data for users to explore the many levels of analysis involved.

Child Sexual Abuse. Illustrates the various physical signs of child abuse and presents a methodology for social workers and teachers to identify these problem signs and take steps to contact the proper authorities. Designed so that audiences who are either unaware of the physical indicators of child abuse or may need review can select the appropriate path best suited for them.

Stress Management. An individualized relaxation program for the viewer is determined through several questionnaires that indicate their current stress level. It then teaches them in a step-by-step manner how to let go of tension and relax their mind and body through the methods they select. The methods of relaxation are: breathing, visualization, yoga stretches, progressive relaxation, meditation, and autogenics.

AIDS Education. Addresses the many issues related to AIDS and sex education for teenagers. Consists of three parts: 1) Random access information bank consisting of AIDS information that teenagers should know; 2) Transfer and practice to assist viewers in relating information to real-life situations. Includes a simulation-based design that asks the viewer to make decisions based on their knowledge about AIDS and how it is introduced, acquired, and could be prevented. 3) Testing can either use a game show format or a standard test to evaluate viewer's understanding of the content. For Junior and Senior High School students.

Health Edutech, Inc.

Health Edutech, Inc. was formed in 1984 to develop educational, informational, and training programs using interactive video technology. A self-described electronic publisher, the primary audiences for Health Edutech programs are the healthcare and educa-

tional markets. Secondary audiences include state, county, and municipal governments; private industry, and correctional facilities.

With the funds from a public sale of 250,000 shares of stock at \$2.00 each, Health Edutech was able to complete production and begin marketing *Hazards in the Workplace*, their first interactive videodisc training program. By April 1985, development costs for the program were recovered with sales to the Minnesota educational community who were complying with the Minnesota Employee Right to Know Act of 1983. Since then, Health Edutech has produced six Level II videodisc programs.

In 1988, Health EduTech, Inc. announced that a letter of intent for the sale of its health-related interactive videodisc courseware to Maxwell Communications Corp. of Greenwich, Connecticut. The sale was to be a \$750,000 transaction with an additional \$250,000 to be paid upon completion of specified government sales. The proposed sale failed to be consummated.

Infection Control

This Level II program is divided into chapters which cover a variety of topics designed to teach three employee groups: Nursing, Housekeeping, and Food Service. Some of the topics covered include Linen Handling, Handwashing/Personal Hygiene, Equipment Cleaning and Sanitization, Wound Care, and Handling of Waste.

Electrical Safety

This program teaches hospital employees about the electrical safety criteria designed by the Joint Commission for American Hospitals (JCAH) for health care facilities. Topics included in the program are Basic Terminology, Hospital Electrical Systems, Dangers, Patient Vicinity, Electrical Safety, and Emergency Procedures.

Fire Safety

Also designed around the criteria developed by the JCAH, topics in this program include What is Fire, Causes of Fire, Levels of Protection, In Case of Fire, Fighting a Fire, Evacuation Procedures, and Prevention.

Back Safety

Designed to teach proper lifting techniques, this program includes lessons on 1) the structure of the back, 2) the use of good body mechanics to prevent back injury, 3) basic principles of good body mechanics for lifting, pushing, reaching, and sitting, and 4) the proper way to perform trunk and back exercises.

AIDS

This program is divided into chapters covering what AIDS is, the diagnosis, transmission, prevention, symptoms, and complications of AIDS, and implication for life-style change. The lifestyle section is divided into two tracks: one for heterosexual audiences and one for homosexual audiences. Short quizzes are included at the end of each chapter.

Sexually Transmitted Diseases

This program begins with an overview regarding STDs and their impact on society, followed by detailed information about herpes, gonorrhea, syphilis, genital warts, vaginitis, viral hepatitis, chlamydia, and AIDS.

Image Premastering Services, Ltd.

The *Birth Disc* is a visual database of 9,000 color and black and white photographs illustrating childbirth. Developed by Artemis and Image Premastering Services, Ltd., this resource library documents the process of birth from pregnancy and labor, through birth itself to the emerging newborn and the postpartum experience.

Images on the disc capture physiologic and emotional details of such diverse prenatal concerns as prenatal care, labor support, vertex and posterior births in a variety of positions, breech, twins, forceps, cesarean and VBAC (vaginal birth after cesarean) births, newborn attachment and sibling/family interaction.

A table of contents and a cross reference index in this Level I videodisc assists user access to images. The comprehensive collection of birth images is presented in 65 chapters and 43 case studies captioned with concise, informative text. The products included in the sale are *Health Hazards in the Workplace*, *AIDS: An Educational Program*, *STD: Sexually Transmitted Diseases Information Program*, and the *Health Care Orientation Series*. The *Birth Disc* may be used to design individualized teaching and learning programs, to facilitate pre-clinical training for childbirth professionals, and to illustrate lectures, inservices and discussions.

Intelligent Images, Inc.

In January 1985, Intelligent Images, Inc. (III) began production on a series of patient simulations designed to provide continuing education to emergency medical personnel. Funded with venture capital, the project was the largest ever in the area of health-related videodisc production—with plans to produce 30 videodiscs at a rate of two each month. Six programs were completed, with several others in various stages of development, when funds were depleted and production was suspended in December 1985.

The series was written and produced under contract to III by the Human Resources Research Organization (HumRRO) in Alexandria, Virginia. The pilot program, *Shotgun Wound to the Abdomen* (Victor Mercedes), has received numerous awards, including "Best Educational Production" by the Nebraska Videodisc Design/Production Group as well as the Leshner Award for "best and most innovative educational communications" at the John Muir Medical Film Festival.

How the Programs Worked

The focus of the series is on the process of decision-making rather than clinical procedures. In each disc the learner must manage a patient by selecting from a series of menus which provide diagnostic and therapeutic procedures, monitors, X-rays, medications, lab tests, fluids, and consultants. The unique feature of these lessons—making them true simulations—is that the results of each decision will vary from moment to moment de-

pending on the patient's status at the time of decision, the prior decisions of the learner, and the passage of real and simulated time.

Patient data such as vital signs, ECG's, X-ray, and lab test results change constantly and are dependent on treatment decisions. The computer keeps track of each decision and, at the conclusion of the lesson, provides feedback to the learner regarding key decision points as well as a cost-of-care analysis. Because some of the lessons are programmed with random complications, the learner may go through the same lesson several times without being able to predict the exact course the patient will take.

A Second Wind

When production was suspended, III released information stating that "initial sales efforts have shown that interactive videodiscs will become a well accepted training method in the future, but that videodisc training is competing for hospital dollars normally associated with capital equipment acquisitions rather than training materials." The company temporarily shifted its focus and initiated "Test Market II" to clarify two areas of current concern: 1) the method of selling the interactive videodisc system as a training system rather than a capital expense and 2) the viability of additional topics within the marketplace that will broaden the market base.

In 1987, III merged with the R2 Corporation (medical supply) to form the DaRox Corporation. Currently, all of III's production and programming is being coordinated by their home office in San Diego, California. III managed to finish production on an additional two patient simulations, bringing the total to eight such programs on the market. The titles of the available programs are: *Abdominal Stab Wounds*, *Chest Trauma*, *A Patient With Diarrhea and Vomiting*, *Motor Vehicle Trauma*, *Diagnostic Decisions in Shock*, *Shot-gun Wound to the Abdomen*, *Initial Assessment of Respiratory Difficulties*, and *Discontinuing Mechanical Ventilation*.

In addition, III has put together eight instructional programs to form the Nursing Assessment and Intervention Series. These programs are titled *Discontinuing Mechanical Ventilation*, *Pathophysiology of Cardiac Tamponade*, *Pathophysiology of Shock*, *Anti-shock Trousers*, *Central Venous Pressure*, *Chest Tubes*, *Auscultating Breath Sounds*, *IV Therapy*, and *IV Solutions*.

Current Sales Status

In the developmental years, III went through several hardware configurations, including the DEC IVIS and Sony View systems. They settled on the IBM InfoWindow system for all of their programs. Packaging and pricing has also varied, with the programs at one time available only in two packages: the Emergency/Critical Care Series of patient simulations costs \$12,200 for the eight programs, and the Nursing Assessment and Intervention Series of programs sells for \$5,500.

Sales of the systems has been slow, due to a number of factors relating to the technology and to the hospital environment. These problems are detailed in the chapter entitled Hospitals. In October 1987, David Allan, M.D., President of Intelligent Images, reported their programs were in approximately 20 medical schools, 20-plus community hospitals, six nursing schools, and several community colleges--for a total of about 50 systems. Although sales have continued since that time, placement has continued to be slow.

Infotronics, Inc.

In November 1987, Infotronics, Inc. of San Diego, California introduced a videodisc library for ophthalmologists. The programs were first introduced at the American Academy of Ophthalmology annual meeting and play on a proprietary Random Access Video Education (Raven) system which uses a Pioneer LD-V2000 videodisc player, color monitor, and custom-designed, programmable, hand-held remote-control unit.

A single-sided videodisc contains 28 short programs used for patient education in the doctor's waiting or examination rooms. The complete Raven system, including videodisc, costs \$3,495 (\$2,495 for additional systems). In the first six months, Infotronics sold more than 500 systems, making it the most widely distributed health-related videodisc program of the time. Following this success, Infotronics is planning three additional discs on ophthalmology and expects to enter into 10 additional medical specialty markets over the next two years.

Interactive Medical Communications, Inc.

Interactive Medical Communications, Inc. (IMC) of Boston, Massachusetts seems to have focused in on a market that will be nurtured by training and education mandates. As of May 25, 1986, the Occupational Safety and Health Administration (OSHA) began requiring various business and industries to educate their workers regarding the health hazards in their work environment. The result was an immediate need for training systems and programs that could communicate the necessary information to a large number of workers as inexpensively as possible.

Chemical Hazards in the Workplace

The first major project for IMC was to develop courseware to bring General Motors (GM) into compliance with the new OSHA regulations. GM installed 1000 interactive videodisc systems in over 140 manufacturing plants nationwide to train 400,000 factory workers on potential hazards of job-related chemicals. The series of programs was developed by IMC in close cooperation with the United Auto Workers union and consisted of nine modules. IMC retained distribution rights to the programs and planned to market them to other potential users.

In May 1986, the commercial version of the GM programs were introduced, titled *Hazard Communications*. The first three training modules, *The Compliance Series*, present vital information needed to meet the ongoing OSHA hazard communication training requirements, including worker right-to-know provisions, evaluation and control of chemical hazards, and potential health effects of hazardous substances. Six additional modules, the *Hazardous Materials Series*, focus on the specific health hazards and the safe use and handling of different chemical groups used widely in industry.

The system enables a company to provide training 24 hours a day, seven days a week, to all shifts without disrupting normal plant operations. The programs teach through the use of filmed worksite dramatizations or simulation, animated images, charts, sound, and text. Employees are asked to make decisions during the instruction, with the consequences of the choices immediately played back on the screen. Incorrect answers

lead to additional explanations and further questions, allowing employees additional opportunity to demonstrate their understanding.

NYC Transit Authority

In 1987, IMC adapted these programs for the the New York City Transit Authority (TA). In all, fifty videodisc systems are being used to help the TA comply with New York state's "right-to-know" law by training 40,000 employees annually.

Three of the six training centers are located in converted buses that travel to a designated location and remain there until workers in the area complete training. The Chemical Safety Training Program consists of 16 modules, each of which provides information, asks questions, and allows the employee to make on-the-spot decisions in simulated real-world situations.

Other IMC Programs

In addition to the health hazard programs, IMC has also developed three programs to provide instruction for workers involved in asbestos removal, forklift operations, and the use of respirator protective equipment.

The *Asbestos Training Program* includes modules dealing with the revised OSHA Asbestos Standard, the history and toxicology of asbestos, evaluation of the asbestos hazard in industry, and proper techniques for asbestos removal and disposal.

Areas covered in the *Respiratory Protection Program* include requirements of the OSHA Respiratory Protection Standard and basic theory of respiratory protection including cleaning, storage, maintenance, inspection, repair and fitting. Instruction also is given on the use of air purifying respirators and air supplied respirators.

The *Forklift Operator Training Program* includes modules covering OSHA standards and forklift applications. Sections on basic forklift safety address all aspects of forklift selection based on types of propulsion and plant location of use. Forklift operation puts trailers, lifting and balancing of loads and methods of in-plant travel.

Master Tape Ventures

Master Tape Ventures of Houston, Texas released a series of videodiscs for ophthalmology patient education in 1988. The series is produced from the more than 60 videotape programs on ophthalmic subjects Master Tape Ventures has produced since it was founded in 1982. The series clearly was intended to capitalize on the market opened by Infotronics of San Diego with their RAVEN system. In 1989, American Medical Communications, Inc. acquired MTV—which continues today as a subsidiary company.

The programs are marketed along with a selection of hardware workstations ranging from a free-standing cabinet unit for \$4,295 to a pedestal or counter top unit for \$3,495. Both prices include one videodisc program. The programs themselves range in price from \$900 to \$1,395.

MTV Ophthalmology Disc 1: Short Topics. This disc contains 23 short topics including Allergic Eye, Blepharitis, Cataracts & Cataract Surgery, Conjunctivitis, Corneal Abrasions, Diabetic Retinopathy, Dry Eye, Macular Degeneration, and more.

MTV Ophthalmology Disc 2: Informed Consent. This disc contains 13 long topics including After Cataract Surgery, Blepharoplasty, Chronic Glaucoma, Diabetic Retinopathy, Macular Degeneration, Retinal Holes & Tears, Trabeculectomy, YAG Capsulotomy, and more.

MTV Ophthalmology Disc 3: Reception Room. This disc contains a documentary style production suitable for an ophthalmology waiting room or health fair. Segments include Introduction to Professional Eye Care, What's Your Eye-Q?, Cataract Surgery: The Routine Miracle, Welcome Message, and Music Video Intermissions.

Medical Interactive

Medical Interactive of Lafayette, California is distributing a videodisc version of the *Radiology Teaching and Reference Library*, a comprehensive collection of radiographic images and teaching materials. Originally developed by the Center for Devices and Radiological Health in cooperation with more than 35 medical schools and residency programs, it represents a library of enormous value to practicing radiologists as well as residents.

The Library's 1,800 cases are a collection of different disease entities, organized into a logical learning sequence. Each case contains 1) a patient history, 2) a detailed teaching discussion, and 3) a diagnosis. The narrative may also include differential diagnoses, protocols for determining the appropriate imaging procedure, a description of how particular X-ray examinations are performed, films from different patients illustrating various manifestations of the same disease, and pertinent references.

The full-sized version of this library has been marketed for many years by the American College of Radiology. Medical Interactive has transferred all of the cases in the Library onto two videodiscs. Disc 1 contains the cases from the Ultrasound/Abdominal CT and the Cranial CT sections. Disc 2 contains the cases from the Chest, Gastrointestinal, Genitourinary, Head and Neck, Pediatric, and Skeletal sections. Taken together, the two discs contain over 20,000 images, more than 1,800 cases, and the equivalent of 2,200 pages of text.

The videodisc version of the Library has been designed to accommodate frequent revisions. Institutions can add material which reflects new medical research, discusses their own techniques and procedures, or discusses other approaches to the same case. Since all enhancements are software-based, they can be shared with other users. Medical Interactive provides the coordination necessary to keep users of the Library informed of these enhanced materials, and distributes them at nominal cost.

Also included with each videodisc is easy-to-use authoring software for developing custom interactive courseware. This authoring tool helps instructors create their own free-standing instructional modules. As different institutions develop libraries of these teaching modules, Medical Interactive may collect and distribute them to other users.

The videodisc version of *The Radiology Teaching and Reference Library* runs on most standard microcomputers and with virtually any videodisc player. A PAL version of the videodisc is available for overseas users.

Murdoch Institute for Research Into Birth Defects

The Murdoch Institute for Research into Birth Defects, located at the Royal Children's Hospital in Victoria, Australia, has developed a videodisc-based diagnostic tool to assist geneticists and pediatricians in identifying syndromes in children with birth defects. Physicians use the product, known as POSSUM, by entering the most striking features of the patient into the computer. The system will then search its database and provide a set of differential diagnoses along with a selection of relevant images from the videodisc. The physician examines the information to confirm the likeness of the features with his or her patient.

The POSSUM Database. The POSSUM database contains information on more than 1000 published syndromes and 1200 patients. It contains over 18,000 illustrations of published cases and of patients from clinics at the Royal Children's Hospital and other medical centers. The published syndromes have been entered from standard texts and the current medical literature and checked against information drawn from the London Dysmorphology database. Standard and rare syndromes are included and referenced with selected citations and the McKusick Catalogue number.

Syndromes included are those with two or more birth defects, dysmorphic patients with mental retardation, selected skeletal dysplasia syndromes and chromosomal syndromes. Pediatric and neurological conditions are only included where there are dysmorphic features and multiple birth defects. Inherited single birth defects are not included at this stage. POSSUM also includes a local case file in which a physician can enter and store coded information about his or her own patients. Although related images cannot immediately be added to the videodisc, these materials may be sent to the developers for inclusion in the next version of the disc to be pressed. All contributions are acknowledged in the system.

Equipment /Licensing Requirements. POSSUM has been run and validated on both the IBM PC/XT and PC/AT microcomputers. The component requirements of the system are 640k bytes of memory, two megabytes of hard disk, a serial port, color or monochrome display, a videodisc player and a video monitor. The system currently supports the following videodisc players: Sony LDP-1500 (PAL and NTSC), Pioneer LD-V4200 (NTSC), and Pioneer LD-V4000 plus a IU04 Interface Control (PAL only).

A three-year license to use POSSUM costs \$3000 and includes access to the software, the syndrome database, videodisc, and the manual. Also included is an annual update of the syndrome database and any enhancements made to the operation/usability of the system plus at least one update of the videodisc within the license period. After the expiration of the three years the licensee may use POSSUM but will not be entitled to any more updates without entering into a new license renewal.

POSSUM may be viewed at 15 centers in eight different countries, including five in the United States. These include the University of California Medical Center (San Diego), Johns Hopkins Hospital (Baltimore, Maryland), Massachusetts General Hospital (Boston), Shodair Children's Hospital (Helena, Montana), and the office of Dr. V.M. Riccardi in Houston, Texas.

Professional Training Systems

Professional Training Systems of Atlanta, Georgia recently entered the healthcare market in 1988 with four videodisc programs: *Understanding Aging*, *Care Basics for Nursing Assistants*, *On the Job Safeguards for AIDS*, and *An Ounce of Prevention*. Each program is part of the Pro-Vision interactive videodisc courseware series and will play on any major hardware system such as the IBM InfoWindow, Sony View, Visage, MCI, etc. Professional Training Systems also offers its own hardware configuration at a lower cost. The programs sell for \$1500 and \$1600 dollars each.

Understanding Aging

This program responds to the need for people to understand the process of aging. Designed for use by students, family members and friends of older persons, older persons themselves, people who work with older persons, and others who want to understand the aging process, the course takes a comprehensive look at the physical, mental, social, work, and financial changes that accompany aging.

Care Basics for Nursing Assistants

This introductory course meets the training needs of nursing assistants working in long-term care environments, and examines the complex needs of residents in long-term care. The program deals with human relations and communications, legal and ethical issues, the importance of accurate observation, reporting and recording, how to control infection and fire safety, and accident prevention.

On the Job Safeguards for AIDS

This program is designed to meet the training and educational requirements specified by the Occupational Safety and Health Administration (OSHA) for healthcare employers. It deals with precautions which can be taken by healthcare workers and other workers to prevent exposure to human immune deficiency virus (HIV), commonly known as the AIDS virus, and other blood-borne diseases such as hepatitis B virus (HBV). The course includes an overview of the AIDS virus, modes of transmission, universal precautions, precautions for specific workers, and future developments with the AIDS virus.

An Ounce of Prevention

Developed for use by child care professionals, this course offers comprehensive training on recognition, reporting, and prevention of child abuse. Topics covered include the magnitude of the child abuse and neglect problem, reporting requirements, and prevention.

ProCare: Nurse Assistant Training

Professional Training Systems has joined forces with the American Health Care Association (AHCA) in Washington, DC and the Educational Testing Service (ETS) of Princeton, New Jersey, to develop and market 80 to 120 hours of videodisc instruction to train and evaluate Nurse Assistants. The curriculum is based on the AHCA's *How to be a Nurse Assistant Instructor* and *Student Manuals*. The programs are designed to meet the

75 hours of training mandated by the federal government for all Medicare and Medicaid certified nursing homes.

At least 16 new interactive videodiscs are to be developed by PTS. Course components will include the important core subject areas: basic patient care, residents's rights, food and nutrition, personal care, accident prevention, resident assessment, infection control, the residents' environment, speech and understanding, responsibilities of a nurse assistant, and the healthcare team. The ProCare series is designed to run on the PTS PV-145 hardware system, which consists of a proprietary controller/keypad interface with a Pioneer videodisc player.

Scholastech Limited

Scholastech Limited of London, England has launched an ambitious videodisc series on human anatomy titled *The Anatomy Project*. When completed, the series will contain 24 disc sides in six general areas: Neuroanatomy (2 disc sides), The Upper Limb (4), The Head and Neck (6), The Abdomen and Pelvis (4), The Lower Limb (4), and The Thorax (4).

The material on each disc will include original linear and still-frame sequences as well as references for self-assessment, cross-referencing, and a glossary. In addition, each disc will be programmed for six separate audiences: Medicine, Dentistry, Nursing, Radiography, Physiotherapy, and Post-Graduate. Each audience group will be led through the discs using a different path matched to their area of interest.

The Anatomy Project discs are designed for use on Level One, Two, or Three videodisc systems. The images may be used without programming (Level One) by students or teachers, who are guided through the images by an accompanying workbook.

The series is also programmed for Level Two operation, and can be played on the Pioneer LD-V6000A series videodisc players or the new Pioneer LD-V8000 videodisc player. Level Two players incorporate an internal microprocessor which allows the program code to be loaded from the videodisc. The code is loaded automatically into the microprocessor and the system is operated by a hand-held remote.

The Anatomy Project also is offered as a Level Three software package in which the videodisc player is controlled by external computer. Software is available for both Info-Window-compatible systems and two-screen IBM PC-compatible systems. Software for two-screen Macintosh systems is being developed.

How the Program Works. When the program is started, a short introductory sequence plays, leading the user into the First Menu of options. At this stage a user level (later also a language) and chapter is selected. By pressing play, the user chooses the default mode and Chapter One is played at the most detailed viewer level (Postgraduate).

Once a valid chapter is entered, the program takes a few seconds to load the programming for that chapter, which includes information on the video sequences, text and pictorial image frames which summarize and revise the chapter content, and a set of self-testing questions. These are organized by viewer level. There is also a Glossary which can be viewed at any time by pressing the AUTO STOP key.

The First Menu, which can be accessed at any time by pressing the left SCAN key, offers a choice of chapters and two subsidiary menus. After a choice is made from one of the other menus, the Main Menu returns to enable users to select the chapter of their

choice. The course level menu enables the user level to be selected or varied using a single numerical keystroke. It can be accessed from the Main Menu or the Extra Options Menu.

The first two discs in the series, *The Eye*, and *The Hand and Wrist* have been completed, with two discs on Neuroanatomy due in April 1990. Each disc sells for \$1,650, with an additional charge of \$250 for Level Three software. A Launch Offer is in effect for the first part of 1990 where, for each disc purchased, a second copy will be provided free of charge. This "two-for-one" offer will apply to all subsequent discs in the series as long as they are purchased in sequence. In addition, the original launch price will be guaranteed for all 24 discs in the series.

The Anatomy Project

NEUROANATOMY

- Disc 1: General neural organization—peripheral and central systems; Brief cytology, synapses and transmitters; Major divisions of the CNS; The forebrain and midbrain.
- Disc 2: The hindbrain, the cranial nerves; The spinal cord, the spinal nerves; The cranial cavity, blood supply and the meninges.

THE UPPER LIMB

- Disc 1: General topography and anatomy of function.
- Disc 2: The hand.
- Disc 3: The forearm and elbow.
- Disc 4: The upper arm and shoulder.

THE HEAD AND NECK

- Disc 1: General introduction to function and topography; The bones and joints of the head and neck.
- Disc 2: The teeth.
- Disc 3: The nose, paranasal sinuses, mouth, pharynx, larynx.
- Disc 4: The face and scalp.
- Disc 5: The ear, preauricular region, infratemporal fossa and pterygo-palatine fossa.
- Disc 6: The neck, its triangles, suprahyoid and vertebral regions, root of the neck.

THE ABDOMEN AND PELVIS

- Disc 1: The abdominal wall and the back—the bones, joints, muscles, and the blood and nerve supply.
- Disc 2: The abdominal cavity—general introduction and topography; The alimentary canal, pancreas and spleen, the peritoneum.
- Disc 3: The kidneys, ureters, and bladder; The vessels and nerves of the abdomen.
- Disc 4: The reproductive system.

THE LOWER LIMB

- Disc 1: General introduction and topography; The anatomy of function—locomotion and posture.
- Disc 2: The foot and ankle.
- Disc 3: The lower leg and knee.
- Disc 4: The thigh and hip.

THE THORAX

Disc 1: The thoracic wall—its bones, joints, muscles, and skin; The diaphragm, intercostal spaces and the breast.

Disc 2: The mediastinum—general introduction and topography; The heart.

Disc 3: The great vessels—the aorta, the vena cavae; The pulmonary vessels; The blood, lymphatic, and nerve supply of the thoracic cavity.

Disc 4: The pleural cavity—the lungs and pleura.

The Training Group

Another 1988 entry into the commercial videodisc market is The Training Group, based in Edmonton, Alberta, Canada. They are marketing a series of 12 Cardiology videodisc programs as well as one each in Emergency Medicine, Mega-Code, and Obstetrics. The programs range in price from \$1,000 to \$1,995, and will play on the IBM InfoWindow as well as other systems.

Cardiology Courseware

The lessons in this series were developed for use by undergraduate medical students as part of their course on instruction prior to seeing and examining patients on the wards or in the outpatient department. They are designed to provide a means for the students to work out the effects of individual heart lesions and then predict the physical findings and important symptoms likely to result. Remedial material is available at each point in the lesson. By the end of each program, the students will have worked out the physical signs, symptoms, and the results of simple investigations required when faced with such clinical problems in practice. The heart sounds and murmurs are presented from a videodisc when the student touches the simulated "body" on the screen.

The Cardiology series consists of the following titles:

- The First and Second Heart Sounds
- Heart Murmurs and Other Sounds
- The Normal Electrocardiogram
- The Abnormal Electrocardiogram
- Mitral Stenosis
- Mitral Incompetence
- Aortic Stenosis
- Aortic Incompetence
- Atrial Septal Defect
- Ventricular Septal Defect
- Pulmonary Stenosis
- Patent Ductus Arteriosus

Emergency

This "real time" emergency simulation of a motor vehicle accident takes place on the street. It focuses on the procedures required to stabilize a trauma patient prior to

transport to a medical facility. The decisions are monitored and student performance is displayed at the end of the simulation.

Dysrhythmia Training and Evaluation

This program simulates arrhythmia. Students can select options that provide the following: 1) a review of basic electrocardiography, 2) arrhythmia recognition, 3) patient simulations, and 4) a performance printout. Instructors have additional options that allow a pre-programming of patient simulation parameters, administration of final exams, and student performance printouts.

Obstetrics

This is a "static time" simulation of the delivery of a baby in a rural community hospital. The decisions made by the students are monitored and their performance is displayed at the end of the simulation.

Veritech Corporation

A series of videodisc programs on orthopaedic topics has been developed by the Veritech Corporation of East Longmeadow, Massachusetts for the Zimmer company of Warsaw, Indiana. Originally developed as a display exhibit for Zimmer, the programs drew such a good response that Zimmer began using them for training workshops. Eventually they decided to market the programs to orthopaedic surgeons.

Known as the Zimmer Learning Exchange, the programs play on a proprietary system which consists of a Pioneer LD-V4200 player, a Visual Data controller which uses a cartridge instead of floppy disks, and a 13-inch Panasonic monitor, and sells for approximately \$2995. Eighteen programs are available in six different packages: Primary Hip, Revision Hip Procedures, Total Knee Procedures, Aspen Labs, The Total Hip Arthroplasty, and Miller/Galante Total Knee System. Each of the programs is designed for use by orthopaedic surgeons, residents, or nurses and qualifies for level 1 Continuing Medical Education credits.

Videodiscovery, Inc

In 1987, Videodiscovery, Inc. of Seattle, Washington announced the beginning of a major videodisc project in dental patient education. Funded by a grant of nearly \$400,000 from the National Institute of Dental Research at the National Institutes of Health, the project produced six interactive videodisc programs for patient self-instruction over a two-year period.

The Dental Patient Education Series is a five volume set of programs employing state-of-the-art videodisc training to prepare patients for major dental procedures such as oral surgery extractions, implants, orthodontics and periodontics. Topics are selected from a menu and presented in a lively combination of computer graphics animation, live video, and still photography. Patients can instantly view and review any section of the program at their own pace for interactive learning. Questions are included to test comprehension and a printed documentation of viewing is provided at the conclusion of the program.

The training station consists of a videodisc player, color video monitor, remote control, headset, and computer printer. Discs are available individually or together with all equipment. Each videodisc comes with User Guidebook, Viewing Guide Pad and Holder, and Receipt Booklet.

Preparing For Jaw Surgery

This disc provides a broad overview of the process of orthognathic surgery designed to prepare patients and speed their recovery. Clear explanations are given for a variety of procedures including what to expect after surgery and what to eat and do to get the best possible results. Information on wired fixation and rigid fixation are presented in separate tracks which can be selected by the doctor. It covers most topics usually presented by oral surgeons during presurgical consultation.

Preparing For Dental Extractions

This disc teaches in detail about the most common dental surgical procedure; the extraction of third molar teeth. It gives a clear explanation of the rationale for tooth extraction and the risks of both extracting teeth and leaving them in place. The actual procedure is shown with simple graphics and live footage selected to increase patient confidence before surgery. All aspects of recovery are explained and the viewer has the opportunity to ask questions of former patients in a simulated interview situation. The presentation is convincing and non-threatening.

Preparing For Dental Implants

This disc provides a complete background on the principles of two-phase osseointegrated implants in terms the layman can understand. Problems of edentulism are presented along with the advantages of treatment using implants. The surgery is explained with non-threatening graphics and clear narrative. Recovery information for the patient will give patients realistic expectations about the process. A simple attitude survey allows users to compare their feelings about dentures to those of other patients before and after surgery. An interview section allows the user to select questions for implant patients about their experiences. The disc is designed to apply generally to most commercial implant products.

Orthodontics

This disc explains orthodontic treatment for both adults and children. The principle of tooth movement is presented so that patients can better understand the need for cooperation for successful treatment. All kinds of orthodontic appliances are clearly explained. Risks of treatment and non-treatment are enumerated. The user selects from interviews with patients who answer common questions. The disc can be viewed repeatedly as each new phase of treatment is introduced. Special attention is given to personal hygiene while wearing braces and the need for conscientious wearing of headgear and retainer.

Periodontal Health

This disc explores the causes and control measures for periodontal disease. The material is appropriate for both general dentistry patients and those who are candidates for

periodontal treatment. Computer graphics and clear video images explain how the disease progresses and how careful cleaning helps remove plaque. All kinds of oral health care measures are taught and varieties of periodontal surgery are discussed frankly in a non-threatening manner. Long-term maintenance is stressed with an emphasis on patient responsibility.

Physics Of Sports

Videodiscovery also produced *Physics of Sports*, an interactive videodisc for analyzing the motion of athletes. This disc provides a detailed visual record of more than 20 athletic events, filmed expressly for scientific analysis. The slow motion observation and measurement of athletic performance using videodiscs can raise many questions. Because of the high interest in sports, many students who may be turned off by "science" are motivated to use formulae and solve problems. The principles and methods of physics are applied to study problems which are familiar and interesting to students. This approach reinforces student understanding of physics concepts thorough application on real world problems.

Medical Publishers

Many medical book publishers have looked at electronic publishing in general, including videodisc publishing, as a possible new venture for their company. In fact, over the past four or five years, there have been several unsuccessful attempts to market videodisc courseware. As a result, it seems unlikely that medical publishers will be a major force in creating and distributing videodisc courseware until the market becomes more stable.

A major problem with marketing videodiscs is that, unlike textbooks, there are no established channels for acquisitions. Every institution is a little different in how it might go about purchasing videodisc programs. Decisions may be made by media centers, health science libraries, teaching departments, physicians, professors, or administrators. This decentralization means that the same marketing effort may have to be repeated many times over in any given institution in order to reach the key person.

Another major problem is demonstrating the program to interested parties—it cannot be demonstrated as easily as a textbook. The solution for most commercial vendors seems to be to create a videotape demonstration of the product for potential buyers to view. This can be followed up by an on-site demonstration if there is a sufficient sales force, or by a program preview if the potential customer already has the necessary hardware system.

Which brings up another problem area. Since there are so few videodisc hardware systems in the field, most buyers will need to invest not only in the program itself—which can range from \$750 to \$12,000 for a series of programs—but will have to buy a \$4,000 to \$8,000 hardware system as well. Most book publishers are not interested in going into the hardware sales and service business.

Publishing Arrangements

In the past, most medical publishers were interested in picking up the rights to an existing program that was developed by a health sciences school. They usually picked up exclusive rights to a program, and handled all replication, packaging, mailing, and promotion. Because the industry is new and has no established royalty standards, the developing institution is in a position to negotiate a return on sales. However, most publishers are used to returning a royalty around 10 percent, and are unlikely to deviate from that figure for videodisc programs. This creates a problem for the developer, since videodisc programs can cost anywhere from \$30,000 to \$150,000 to produce, with most school programs falling somewhere in between. Books, on the other hand, require a much smaller investment to write.

With these kinds of problems to face, most medical publishers are standing on the sidelines waiting for a better opportunity to present themselves before investing in videodisc publishing.

Mirror Systems, Inc.

Mirror Systems, a subsidiary of the publishing company Times Mirror, is a design and production company located in Cambridge, Massachusetts. In 1987 they developed the videodisc program *Introduction to Cardiovascular Examination* as a test product. Times Mirror wanted to see what they could do in the way of producing exemplary videodisc instruction as well as how well such a program would sell in the marketplace.

The first objective was achieved with flying colors, with the program being very well received by the medical and nursing communities. The program provides two to four hours of instructional content for use by a broad range of medical and healthcare professionals. The course allows the student a high degree of interactivity with images and text through touch sensitive controls, as well as the ability to navigate through the system at an individualized pace. The system supports questioning of the student for score reporting and instructor evaluation.

Distribution Ceases. *Cardiovascular Examination* plays on the IBM InfoWindow and was being offered for \$1000. However, the program failed to sell especially well, with only about 50 copies distributed by the end of 1989. As a result, Mirror Systems announced that it has discontinued sales of its *Introduction to Cardiovascular Examination* videodisc course effective November 30, 1989, and the course was withdrawn from the market.

The decision to discontinue sales of the program reflects the current state of medical videodisc publishing. The course is still highly regarded and was among the first to clearly demonstrate the effectiveness of the videodisc medium in medical and nursing education. However, the lack of a substantial installed base of compatible videodisc playback systems, together with continuing changes in optical media delivery hardware, have made it impractical for the company to continue to sell and support the product.

Mirror Systems, a part of the Times Mirror Company, is continuing to develop interactive videodisc, although nothing is planned in the way of health sciences topics. Its latest accomplishment was a joint effort with sister Times Mirror company, Learning International. Released in May and marketed as *The Sales Challenge Videodisc Series*, it consists of five single-sided discs devoted to reinforcement of interpersonal selling skills.

In the health sciences videodisc area, where *Introduction to Cardiovascular Examination* had an award-winning record, the company is continuing to evaluate opportunities both for itself and on behalf of health science publishing companies within Times Mirror.

Williams & Wilkins Publishing Company

Williams and Wilkins Publishing Company (W&W) added videodiscs to its marketing list in 1985 with the acquisition of the University of Iowa's program, *Assessment of Neuro-motor Dysfunction in Infants*. W&W had been considering the area of electronic publishing for several years, and first entered the market less than two years prior with several software programs for computer-assisted instruction.

In an attempt to market the program, W&W exhibited the program at major medical meetings that deal with neurology and pediatrics so that participants would have a chance to view it. They also performed a lot of telephone work promoting the program, encouraging people to somehow acquire the necessary equipment so they can have the program for a 30-day review period. In addition, they invited representatives from schools in Philadelphia, Baltimore, and Washington to come to their offices for demonstrations.

Though the *Assessment* program has not been a commercial success, in early 1986 W&W was still interested in acquiring additional videodisc projects, and was looking closely in the areas of anatomy, pathology, and dermatology. Other areas of interest to W&W are allied health fields such as physical therapy, occupational therapy, speech, language, and hearing. They stated that they would like to learn from their venture before they actively pursue other projects, but would entertain the idea of marketing existing videodiscs in their areas of interest.

The Electric Cadaver. In late 1988, Williams and Wilkins picked up a one-year option on the rights to an electronic textbook of human anatomy developed by Stanford University Medical Center researchers. Combining text, computer graphics and full-color video, *The Electric Cadaver* allows a user to interactively explore the structure of the human body in a way unavailable in conventional printed books.

The system displays images on two screens, one for computer graphics, the other for full-color video. A user can "jump" from picture to text to video and back, just as a reader jumps from place to place in a printed volume. Williams and Wilkins, after examining the market, failed to exercise their option.

Scott, Foresman and Company

In 1988, Scott, Foresman and Company, of Glenview, Illinois produced a Level 1 and Level 3 videodisc entitled *The Psychology Encyclopedia*. The program contains 14 minutes of motion and hundreds of still frames which define basic psychology terms. The imagery provides extensive support to Scott, Foresman and Company textbooks.

Psychology instructors will use the discs as a classroom aid to illustrate and expand upon textbook concepts and lessons. The program is divided into 11 chapters of psychology study: Intro/Methods, Biological Bases, Sensation/Perception, Developmental, Intelligence-Cognition, Learning & Memory, Testing, Motivation and Emotion, Abnormal, Social, and Human Sexuality.

In addition, computer database management software can also be used to control the program in a Level 3 mode. Scott, Foresman and Company is planning to develop controlling software to support the program. According to Darrell Schweppe, project leader, "the greatest challenge in producing *The Psychology Encyclopedia* was formatting existing transparencies for the videodisc medium. Each image had to be digitized and re-touched using the electronic paint box, including removal of all the transparency text to replace it with larger electronic text. The original transparencies were of such high quality that every effort was made to transfer that quality to the finished videodisc."

MEDCOM

In February 1984 EECO Incorporated announced the development of a new system for compressing ten seconds of audio information into every frame of video. Using the EECO system, one 30-minute videodisc could hold 54,000 frames and up to 150 hours of audio information. MEDCOM, a subsidiary of Baxter Travenol Laboratories, received their first EECO system in July 1984. It was used by TRAINEX, a division of MEDCOM, to duplicate portions of their large library of filmstrips and slide/tapes.

TRAINEX used the EECO system as the basis for what was called Autocomm Centers for self-controlled learning. The Centers were to be portable playback units containing a Commodore 64 computer, a videodisc player, and a color monitor. The first TRAINEX disc contained nearly 200 slide/tapes and filmstrips on topics in Patient Education, Physician Education, Nursing, and Allied Health. More than 140 hours of sound were programed onto the disc, which was originally expected to be available for purchase in the early part of 1985. However, technical problems, combined with the sale of MEDCOM, seem to have killed the project altogether. Recently, MEDCOM has been reexamining the interactive video market, although they have not announced any plans to come out with a product.

J.B. Lippincott Company

In early 1985, the J.B. Lippincott Company, a major publisher of medical and nursing books, announced their entry into the videodisc market with plans to produce a series of 12 Level III videodiscs for the health professions. The series, based on the highly successful textbook and film series, *A Guide to Physical Examination*, by Barbara Bates, M.D., was to be designed for independent study and as an instructional aid.

The series was to be produced by taking the existing film sequences and adapting them to the videodisc format. The user would learn all techniques essential for the physical examination of a patient by performing a simulated exam using the videodisc program. By the fall of 1986, however, Lippincott announced that they would no longer produce or acquire computer-assisted software—including videodisc programs. With this announcement came the dissolution of the Media Development Department of Lippincott.

W.B. Saunders Company

In 1984, the W.B. Saunders Company joined forces with the Thomas Jefferson University Hospital to produce a Level II videodisc on ultrasound called *Sight Through Sound: An Interactive Introduction to Medical Diagnostic Ultrasound*. The project was

funded by CBS, which then owned Sanders, as a prototype disc to test the market. The disc was produced by now defunct Interactive Video Concepts with a budget around \$100,000, and has sold around 150 copies--about half of what is needed for Saunders to "break-even."

The disc was marketed primarily by direct mail, with some support from the Saunders regular sales force. Since Saunders was not selling videodisc hardware systems, the biggest problem they had was locating potential buyers with videodisc equipment. After about a year of marketing, Saunders stopped marketing the disc actively, although it is still available for purchase from their Electronic Publishing Department.

Evaluating *Sight Through Sound*

As part of a presentation to the Jefferson University Medical School, Larry Waldroup, Chief Technologist in Ultrasound at Thomas Jefferson University Hospital, demonstrated and discussed *Sight Through Sound*, offering some useful insights into some problems encountered by this disc.

The target population was too broadly defined. In an attempt to make the disc attractive to as broad an audience as possible, the topic focus was too diffuse and the disc lost its usefulness for any one group. Some segments addressed technologists while other segments addressed interns. Segments of the disc could be useful in an introductory course, but Waldroup feels it is impractical to use it in such a limited way.

The logistics of playback were inconvenient. Because many departments do not have their own videodisc player, the inconvenience of arranging for the loan of a machine blocked the routine use of the videodisc. As long as there were no other videodiscs on the subject, it was not practical for departments to purchase their own videodisc player.

The disc was not reliable. Either because of bugs on the disc (some have been identified) or problems with the videodisc player, the program was not completely reliable.

Plans for the Future

One Saunders representative feels the future for this type of electronic publishing may lie in the newer technologies such as CDROM or CD-I. He feels these formats will require a smaller, less-expensive delivery system that schools, hospitals, and individuals will be able to afford. He also points out that much of medical publishing does not require the motion sequences that videodisc is best suited to present. Text, graphics, and picture-quality stills represent the majority of information medical publishers are interested in distributing, all of which will be better handled by CDROM and CD-I formats.

Failed Commercial Ventures

Over the years, there have been a number of commercial ventures which were initiated but, for one reason or another, have since ceased to exist. For the purposes of a historical perspective, some of these programs are included here.

E.I. DuPont de Nemours

In 1983, Healthcare Learning Systems, a division within the DuPont Company, began looking at interactive videodisc training as one component of a total hospital man-

agement system which was being developed by the DuPont Company. In order to test the usefulness and acceptance of the technology, they funded the development of a prototype program called *Critical Care Nursing*.

The program began with video segments of the ocean, accompanied by classical music to relax the learner. A blue cloud "mentor" then appeared to guide the learner through the lesson. The learner has a choice of listening to male or female voices throughout the lesson. Function keys allowed the learner to access help, eliminate graphics from screen video, go to menu, or exit program. Each learning segment included a Knowledge Assessment Learning Options, and References.

Topics covered include: 1) Shock, explained at the cellular and microcellular level; 2) ABG's, with segments on Acidosis vs. Alkalosis, Metabolic vs. Respiratory Condition, Compensation, Mixed States, Quick Reference, and Lab Results; 3) Cardiac Arrhythmias, with segments on Cardiac Arrhythmias Recognition, Electrocardiology and Electrophysiology, Anatomy of Heart and Circulatory System, Lead Placement, and Simulation; and 4) CPR, with segments on One Person CPR, Two Person CPR, Code Management, and Children. The program originally was developed on an IBM-based system and later converted to run on the DEC IVIS hardware (the first integrated videodisc system, no longer made). The project never went anywhere and Healthcare Learning Systems is now defunct.

ITEST, Inc.

International Training and Education Systems Technology, Inc. (ITEST) first promoted its product, *First Responder*, in 1984 as a portable first aid station, complete with videodisc player. The 100-pound metal cabinet contained emergency medical supplies, a Pioneer LD-V4000 videodisc player, and a Tektronix seven-or nine-inch monitor. Using a combination of videodisc and medical supplies, the First Responder was designed for use at work sites and recreational areas where access to established emergency services are not readily available--such as oil rigs, submarines and state forests. The original price of the unit was under \$9,000, with quantity discounts available.

First Responder consists of two separate modules: the video components and the medical components. The video component is made up of a Pioneer LD-V6000 videodisc player and a 13-inch color monitor. Ten of the most common work-related injuries and their medical care were recorded on the videodisc which accompanies the system. The medical component consists of medical supplies in compartments color coded to correspond to designated injury categories.

A recent attempt to contact ITEST for an update was unsuccessful, with the last known phone number having been disconnected. It is assumed that the product is no longer available.

Presbyterian Hospital of Dallas

In 1982, when videodisc technology first emerged as a promising educational tool, the Presbyterian Hospital of Dallas took a bold step and began production of a series of videodiscs designed to provide patient education on Diabetes. The completed series was to have three levels: 1) The Basics, and introduction for newly diagnosed diabetics; 2) The

Core, for all diabetics, even those with extensive knowledge; and 3) Special Interest Programs, including the insulin pump, pregnancy, human insulin, etc.

Of these, only The Core was finished before distribution problems stopped production. The finished program, *A Diabetes Primer* was produced first because it was considered to benefit the greatest number of diabetics. It consists of six programs on three double-sided videodiscs.

Distribution of these Level II videodisc sets was halted soon after production because the company licensed to market the programs filed Chapter 11, putting the marketing rights in limbo. Since that time, a few discs were distributed on request by the Presbyterian Hospital of Dallas, who no longer has any copies of the program left.



Chapter 7

Public Organizations

In the past, many publicly funded organizations lead the way in the research and development of interactive videodisc programs. Although most of these programs were used only within the sponsoring organization, they served as valuable prototypes for development by other groups. In addition, these public projects support many smaller, private firms, helping to sustain them until the videodisc industry as a whole becomes more commercially viable.

National Library of Medicine

With over 3 million books, journals, and pictorial materials, the National Library of Medicine (NLM) is the world's largest research library in a single professional field. It is located just outside Washington D.C. as part of the National Institutes of Health in Bethesda, Maryland. NLM serves as a national resource for all U.S. health science libraries, providing lending and search services through a Regional Medical Library Network. This network consists of 2000 "basic unit" libraries (mostly at hospitals), 125 Resource Libraries (at medical schools), seven Regional Medical Libraries, and the NLM itself.

Lister Hill Center

The research and development arm of the Library is the Lister Hill National Center for Biomedical Communications. The Lister Hill Center was developed to explore the uses of computer, communication, and audiovisual technologies for the organization and dissemination of biomedical information. Currently the Center is investigating the potential of optical videodisc technology for document storage and retrieval, and as an interactive teaching tool for Health Sciences education. To date, the Center has produced the following videodisc projects.

Basic Medical Pathology

This is the first of the Lister Hill Center's videodisc projects, begun in 1981. The original disc covers the topics *Cellular Alterations and Adaptations* and *Cell Injury and Cell Death*--two topics presented in most courses in Medical Pathology. Each side of the disc is supported by a pretest, a study module, and a posttest.

Field testing of this disc began in June 1983 at 36 medical schools. Revisions prompted by the field tests have resulted in a new version, distributed to test sites in August 1985. The program software supports Apple and IBM PC computers and a variety of

players and interfaces. Additional videodiscs are planned to cover topics including Necrosis, Inflammation, Neoplasia, Cellular Accumulation, and Circulatory Disturbances.

Radiology.

A collaborative effort with the National Center for Devices and Radiological Health of the Food and Drug Administration, the *Radiology Videodisc* contains radiographs from twenty-two cases selected from the American College of Radiology Learning File. A computer program has been developed to permit radiology consultants to enter the content for clinical case simulations into text files that will be used to present simulations to students, radiologists, and other physicians. When at least six patient management cases have been completed, the programs will be released to schools for testing.

Dental Simulation

This project involves the presentation of a dental case simulation. The initial work was done at the University of Nebraska Dental School, where faculty developed several case simulations suitable for presentation by computer-controlled videodisc players. In 1981 one of the simulations was reformatted to videodisc and the computer program translated from TUTOR to the 8080 PILOT language. The programs are now being translated to run on Apple II and IBM PC computers and should be available for testing soon.

The Case of Frank Hall

This is the first in a series of videodiscs designed to demonstrate the use of videodisc/computer technology for the creation of instructional medical simulations. As part of the TIME project (Technological Innovations in Medical Education) *Frank Hall* is a simulated patient who comes to the emergency room complaining of weakness and abdominal pain. The user plays the part of a physician and attempts to diagnose and treat the patient. The user elicits information by speaking control words into a voice recognition unit. This lesson will eventually consist of three discs, and therefore will require three videodisc players to be interfaced with a IBM-PC/XT computer.

The Case of Patricia Fletcher

This is the second simulation in the TIME project. *Patricia Fletcher* is a morbidly obese, middle-aged college professor who is besieged with personal problems and wants a gastroplasty. This case consists of more than 300 video scenes depicting the medical, social, and psychological problems of obesity and a range of therapeutic choices ranging from an eating disorders clinic to the surgical procedure requested.

Historical Prints & Photographs

This Level II videodisc was produced as an experimental project designed to 1) evaluate the potential of laserdisc technology for improving access to still picture collections, 2) assist in determining whether the benefits of videodisc technology justify the costs involved, and 3) to provide valuable information to help guide future ventures in this area. The disc contains more than 1000 of the most requested prints and photographs from the NLM's History of Medicine Collection.

Microanatomy Tutorial

The National Library of Medicine has combined videodisc and bar code technology to produce a Tutorial Environment System (TES) for medical students. This specially constructed system enables a student to sit at a console and access an entire study plan that incorporates the senses of sight, hearing, and touch. The system consists of a series of modular cabinets which contain a videodisc system and learning materials—including bar coded textbooks and anatomic models. Seated before this array of materials, the student can interact with TES using a digital scanning wand which reads the codes placed on the models and throughout the books. These codes activate segments on the videodisc which explain or extend the material being studied.

Orthopaedic Surgery

This project is a collaborative effort between the Lister Hill Center and the American Academy of Orthopaedic Surgeons. The project goals are to produce a prototype videodisc for testing and use as a continuing education vehicle for orthopaedic surgeons, and to study the value of interactive video in a clinical continuing education setting.

The program will present a simulated patient with knee injuries. The practitioner will be required to take a history, do a physical, make a diagnosis, and propose a treatment plan. The visual database will contain audiovisual sequences that show the patient responding to history questions and undergoing knee exams. It will also show radiographs, arthrograms, and arthroscopy.

CT, MR, and Multiplanar Knee Anatomy

The flip side of the Orthopaedic videodisc contains a collection of images that can be used for instructional purposes. One such program was written at Lister Hill by Kevin W. McEnery, MD, [a recent graduate of Georgetown University School of Medicine].

Interactive Atlas of Knee Anatomy

A videodisc based atlas of knee anatomy was developed by Kevin McEnery, MD with the American Academy of Orthopaedic Surgeons and the National Library of Medicine. The interactive atlas presents a dramatic view of knee anatomy using more than 450 knee images stored on the videodisc, including computerized tomographic, magnetic resonance, and anatomic images.

Modern radiology consists of traditional plain film examinations supplemented by computer-based modalities such as computer tomography (CT) and magnetic resonance (MR). These modalities require knowledge of cross-sectional anatomy which, until recently, was not traditionally incorporated into the medical school curriculum. Given that computers are necessary to acquire these cross-sectional images, the computer should also be used to teach their interpretation to medical students and experienced clinicians.

Using the IBM InfoWindow hardware system as a delivery system, McEnery developed an atlas which is managed by a window-based graphics interface accessed by touchscreen or keyboard. This interface gives the user complete control over image presentations, selecting parameters including modality (MR, CT, anatomy), image plane (axial, sagittal, coronal), and whether images will be viewed sequentially or individually.

At a given location (eg. the mid-knee in the sagittal plane) the user may open the "image window." By touching another modality name, eg. MR, the MR image of that exact location will be displayed. Movement through the images of this new modality may then be selected.

The atlas function of the program allows interactive learning of anatomy. The option window is opened and the user touches "atlas on." In less than a second all the anatomic structures on the image are labeled. The option is available to erase the labels and simply touch the location of a structure and an identification label will be printed next to the structure. Quiz modules present computer-created questions to test the student's knowledge of anatomy. The questions may be requested on a given image, section, modality, or the entire image database. Computer question generation eliminates redundant questions and forces the user to learn the anatomy and not the questions created to test their knowledge.

National Institute of Mental Health

An interactive videodisc curriculum on teenage suicide and depression has been developed by the National Institute of Mental Health (NIMH). The program *Suicide Intervention: Assessing Teenagers at Risk*, concentrates on developing decision-making skills and knowledge on the following areas: 1) Depression and its relationship to suicidal behavior, 2) Interviewing adolescents, 3) Assessing suicidal risk, 4) Family matters, and 5) Intervention and follow-up.

Students using the program learn about these topics by conducting interviews with adolescents, analyzing their data, and making decisions about diagnosis and treatment. Factual information is interwoven with the cases. All the cases have practical realities such as time constraints, interruptions, attitudes, conflicting demands, and limited options for intervention built into the presentations.

Four Simulated Cases

The case of *Edward* is a post-mortem review which highlights risk factors. No one responded to these risk factors which, in hindsight, were obvious indicators of the potential for suicide.

John is a depressed and potentially suicidal teenager who comes to visit his family doctor because he "feels sick." The learner controls the interview with John by selecting what questions to ask. This case also illustrates how the attitudes of a clinician may influence his or her ability to deal with a patient in a crisis.

Shari is an inarticulate 13-year-old girl who has taken a drug overdose impulsively. This case highlights techniques that can be used to draw out such a youngster and includes a "video glossary" which demonstrates various interviewing techniques.

Lisa is a 15-year-old girl whose mother brings her to the pediatrician because she refuses to go to school. This case illustrates how problem-solving techniques can be used to help relieve depression in a youngster.

The curriculum was initially designed for third and fourth year medical students who plan to specialize in pediatrics and family or general practice. The program was plotted in four medical schools in February 1986 and has been revised based on the results. Design and production of the disc was done by Lunaria Incorporated, with support

from the Lister Hill National Center for Biomedical Communications at the National Library of Medicine.

United States Navy

The Naval Health Sciences Education Training Command (NHSETC) has initiated the development of a large-scale videodisc network to serve their education and training needs. The Computer-Assisted Medical Interactive Video System, or CAMIS, is being used in Naval schools and hospitals for refresher training and continuing education. The Navy already has placed 150 of the IBM compatible CAMIS units in select schools across the country. By the end of 1988 the Navy will have a total of 210 videodisc systems placed in its schools and hospitals.

When asked about the Navy's interest in purchasing off-the-shelf software for these systems, one Navy representative replied, "I would say our interest in existing material would be fairly high because of the high cost of development. If there's something we can run that has applicability, either videodisc or CAI, we'd be interested in taking a look at it." The following is a sampling of programs being developed for the CAMIS system.

Basic Anatomy and Physiology is an eight-part series developed by the University of Maryland University College from existing videotape. The series consists of eight videodisc sides containing more than 20 lessons. The lessons require the corpsmen to demonstrate an understanding of the pathology underlying the medical conditions they treat.

Emergency Medical Conditions is designed to provide training to hospital corpsmen on how to recognize, treat, and report basic medical conditions such as angina pectoris, insulin shock, or myocardial infarction. It is produced from the point of view of two Navy corpsmen, with each vignette beginning with a summons to the scene. The learner is then presented with a patient who is suffering from a medical condition that he must diagnose and treat.

Combat Trauma Training is designed to train non-surgeon physicians in the diagnosis and treatment of injuries commonly suffered in battle. The program was produced under the DOD banner and will have application to all ground force combat situations. The program is designed so that the videotaped "patient" actually represents seven different patients, depending on which symptoms and sequences the computer selects.

Basic Medical Skills--Part 1 contains six major lessons: vital signs (temperature, pulse, respiration), blood pressure, assessment, hemorrhage control, shock, and soft tissue injuries. The student may study these in three different modes: Learn, Review, or Look-Up. Learn goes through all the material in a lesson in sequence. Review allows selection of a topic and exercises within a lesson. Look-Up provides information on a specific topic within a lesson.

Mediquiz. Much of medical training and evaluation involves multiple choice tests of medical fact knowledge. Medical and allied health students and practitioners often study for such tests by reviewing old examinations and/or purchasing the books and services of a thriving preparation-for-testing industry. *Mediquiz* frames such a review in the context of a medical gameshow. *Mediquiz* is a simulation in the sense that the show changes with each playing: the questions vary; moderator's patter varies and the abilities of other, computer-generated, contestants vary.

Oral Examination Assisting provides practice in dental charting including charting missing teeth, identifying various types of amalgams, recognition of amalgam shapes, and location of fillings.

Other programs being developed by the Navy include: *Intermediate Medical Skills*, and *Advanced Medical Skills*, *Recognition and Management of Acute Respiratory Conditions*, *Recognition and Management of Common Dermatologic Conditions*, *Recognition and Management of Acute Cardiac Conditions*, *Recognition and Management of Genitourinary Conditions*, and *Recognition and Management of Abdominal Pain*, all refresher training for independent duty corpsmen; and *G-Force Loss of Consciousness*, a program in Aviation Physiology.

Uniformed Services University of the Health Sciences

The Uniformed Services University of the Health Sciences (USUHS) has established the Center for Interactive Media in Medicine (CIM), a new department dedicated to the development and production of quality interactive video instruction for medical education. The mission of CIM is to provide a focus for research and development of interactive media for general medical education for the university and for graduate medical education within the Department of Defense.

CIM's team of instructional designers develop interactive video-based patient simulation programs by working with subject experts and researching existing course content. CIM also provides support to faculty for design and development of interactive courseware, and helps them evaluate software used to author interactive courseware on their own. CIM was created last summer when the university recognized its need to have a focal point for interactive video development. Joseph Henderson, MD (formerly of USUHS, now with Dartmouth Medical School) has written and produced several award-winning interactive videodisc programs.

Award-winning Productions. Before CIM's creation, Dr. Henderson wrote, designed, and produced two interactive videodisc programs. In the first, *Advanced Combat Trauma Life Support* (ACTLS), military physicians and medical students are "given orders" to report to the Ninth Combat Zone fleet hospital. Upon arrival, nurse Laurie Matthews whisks the learner, alias LT Clark, to the rear of the triage tent, where a young Marine who has been shot in the chest struggles for breath. LT Clark must correctly and speedily diagnose and treat this combat casualty to achieve a high score. The ACTLS program is used in conjunction with C4 course held at Fort Sam Houston, Texas. ACTLS won the Best-Overall Achievement Award from the Nebraska Videodisc Group in 1987, and it received the "Golden Award in Critical Care" in 1988 from the John Muir Medical Film Festival.

The second project, *MediQuiz*, provides a review and drill of basic medical knowledge in an entertaining gameshow format for the US Navy medical paraprofessionals. The project was completed with a modest budget, and is repurposable; the same videodisc can be used with different questions for different audiences. To date, *MediQuiz* projects have been completed for hospital corps "A" school personnel and for laboratory technicians (*MediQuiz: Lab Tech*). *MediQuiz* for operating room technicians (*MediQuiz: OR*) is soon to be released.

CIM has begun to work with the Department of Anatomy to produce *MediQuiz: Gross Anatomy*, for second-year students. In addition to *MediQuiz: Gross Anatomy*, CIM has

begun work with the university on a videodisc project tentatively called a *Review of Clinical Human Wrist and Hand Anatomy*.

CIM is ready to release for beta-testing the interactive videodisc program *Preventive Medicine in the Combat Theater: Regimental Surgeon*. the two-sided disc is in a full-featured computer adventure game format and centers around its Navy doctor-protagonist, who is assigned to a US Marine regiment in a hypothetical Middle Eastern combat zone. His challenge is to gain all the information he can to prevent a malaria epidemic. But he is working against time—his regiment is preparing for an encounter with the enemy in less than 48 hours. Not only that, but his superiors are less interested in supposed medical problems than they are in the tactics of the impending battle. The program includes a decision support system with online documents, icon-based maps, and a constantly changing environment.

United States Army

The Army made three videodiscs around 1984 through their Communicative Technology Office at Ft. Monroe, with the assistance of the Learning Resources Lab and the Health Services Command at Ft Sam Houston. The discs were produced as a research and development project, and concentrate on *Intramuscular Injection* and *Crisis Counseling*.

More recently, the Army has shown renewed interest in videodisc technology, and is now developing simulations for eight critical skills common to all U.S. Army medical corpsmen. The skills include 1) taking vital signs, 2) starting an IV fluid, 3) performing the four general techniques used in a physical examination, 4) performing a one-man CPR, 5) performing physical examinations of the respiratory system, cardiovascular system and muscular/skeletal system, and 6) transporting a casualty. The design and production is being done by Kinton, Inc. in Bailey's Crossroads, Virginia.

Florida's Department of Health and Rehabilitative Services

The umbrella social work agency in Florida is the Department of Health and Rehabilitative Services (HRS), which decided in 1979 to convert a major pre-service training program from conventional standup mode to interactive videodisc format. The program chosen for conversion was Aid to Families with Dependent Children (AFDC), which is responsible for the distribution of approximately \$200 million annually to eligible recipients. Training of newly hired workers to determine eligibility was federally mandated, resulting in the development of this 160-hour videodisc training program.

The University of West Florida's Office for Interactive Technology and Training was selected to design and produce the programs, and began work in October 1981. The completed package, delivered in February 1984, consists of nine videodisc sides, 78 computer floppies, eight printed reference books, and extensive trainer's guide. The HRS made an initial purchase of hardware delivery systems composed of Pioneer 7820-3 players interfaced to Apple II computers with the Colony VAI-1 card. The total number of delivery systems is now nearly 100, which are dispersed throughout the state in the 11 geographical districts of HRS.

During pilot testing of the program, findings indicated that trainees covered the material an average of 25 percent faster than their counterparts in conventional stand-up training, and that when taking a common written examination, the pass rate was higher for the interactively trained groups than for the conventionally trained groups.

Children's Medical Services

The Children's Medical Services (CMS) is a state-supported program in the Florida Department of Health and Rehabilitative Services. The mission of the program is to provide medical services to children up to the age of 21 who have chronic handicapping conditions. CMS nurses are responsible for the coordination of services prescribed for each individual child.

In order to cope with diverse training needs of these nurses (in 30 different locations throughout the state), the CMS contracted in 1981 for the development of computer-based videodisc programs on Spina Bifida and Human Genetics. Today, at least 10 different videodisc programs have been developed, with topics ranging from Cleft Lip and Palate to Pediatric Cardiovascular Defects.

In 1984, the informal assessment of the system by CMS representative was as follows:

Overall Impression of the System. Having a system of this type in 30 CMS locations opened a new perspective on training. For the first time, CMS had a system that allowed staff to receive training in their work environment. Not only is professional development instruction delivered, but operational instruction, leading to more efficient and effective clinic operation, also is possible.

With good instructional design, computer-based instruction allows the learner to enter the instruction at a level that is selected based on his or her learning needs. Instruction can be provided for different levels of expertise. Lessons can be designed to be menu-driven where the learner selects what he or she wants to learn. In addition, lessons can be designed to test, reinforce, and branch backward or forward to appropriate instruction.

Cost Analysis. Most significant is the savings in time and money for CMS staff to participate in training programs. Traditional workshop training costs remain essentially the same per student hour over time regardless of how many students receive instruction (due to travel costs, reimbursement for expenses, work release time, etc.). However, using individualized videodisc instruction, the cost per student hour drops over time as the number of students increases.

A workshop for 100 persons might cost approximately \$44.00 per training hour (in 1983). The individualized videodisc instruction for comparable material would cost approximately \$100.00 per training hour (based on a developmental cost of \$90,000 for the program). However, the cost for the next 100 people using the videodisc training would drop to \$55.00 per training hour because the only costs reincurred are work time and maintenance. For the next 100 people using the videodisc training, the costs would drop to \$40.00 per training hour, etc. Obviously, the initial high development costs of computer-based instruction must be viewed in terms of a long-term gain.

User Reaction. User reaction has been overwhelmingly positive. Nurses feel that the instructional packages provide them with convenient on-the-job training that enhances their case management skills. Since the learning system is housed in a movable carrel, the nurses can move the learning system to their offices or other selected locations. The nurses have been especially pleased with the quality and comprehensiveness of the training packages. Because nurses are able to select what they want to know, they feel that they are tailoring the instruction to accommodate their individual learning needs.

Alberta Vocational Centre

The Alberta Vocational Centre has developed two videodiscs for health care professionals. The first disc, *Urinary Catheterization*, instructs nursing assistants and nursing/medical students in the correct procedures for urinary catheterization, and was produced with the Alberta Educational Communications Corporation. The second disc, *Sterile Techniques at the Bedside*, takes the student through the various steps necessary to prepare and change dressings while maintaining sterile conditions at the bedside.



Chapter 8

Professional Associations

Though most professional associations have limited funding available for research and development, several organizations have been involved, to varying degrees, in the development of videodisc programs for continuing education.

American Heart Association

The first Association to become involved in videodisc development for the health sciences was the American Heart Association (AHA). Under the direction of David Hon, then National Training Manager, the AHA sponsored what is actually one of the first videodisc programs of any kind, and certainly the first using an interactive manikin.

The program is now packaged and marketed by Actronics, Inc. in Pittsburgh, Pennsylvania under license from the AHA. Known as the CPR Learning System, the program was originally produced in 1981 as a means of significantly increasing the number of persons trained in cardiopulmonary resuscitation (CPR). Today, the Learning System consists of a microcomputer, videodisc player, random-access audiocassette player, two monitors, course software, and adult and infant manikins which are wired with electronic sensors.

How The System Works

The program presents "classroom" material using the videodisc player and audiocassette player. Using a light pen, learners can evaluate their progress by taking short quizzes at the end of each section. Based upon this evaluation, appropriate video segments are selected by the student to provide review sequences and more in-depth instruction. At all times, the program provides continuous and immediate feedback.

Most impressive is the ability of the system to monitor the learner's actions using one of the CPR manikins. The manikins are equipped with sensors and activators to provide feedback to the student and monitor performance on all components of CPR procedures, including pulse check, call for help, chest compressions, back blows, ventilations, open airway, etc. As with the live instruction, the program will provide on-going feedback while the student works with the manikin. The System will "coach" the learner by producing audio tones to indicate proper timing of each compression and displaying a graphic summary on the monitor which details the learners overall performance. During practice the student's performance on the manikin is immediately evaluated by the computer, which, if needed, selects the appropriate coaching responses from the videodisc.

At the end of the lesson material and practice sessions, the learner is able to test his or her knowledge of CPR using the manikin. Performance standards are based on the AMA's standards and guidelines for CPR. Without the assistance of a live instructor, learners are able to certify at both the Heartsaver and Basic Rescuer levels and receive the AHA Certification Card.

A Growing Videodisc Library

Using the same Learning System hardware, Actronics is continuing to produce continuing education programs for the American Heart Association. The next program developed was *Arrhythmia Recognition*, the first in a series of videodiscs designed to teach the Advanced Cardiac Life Support course offered by the AHA. Also completed at the end of 1986 was the *Airway Management* program, the second disc in the ACLS series. Programs to follow include *Adjuncts*, *Pharmacology*, *Megacode*, and *ACLS Test Disc*. For more information on the Learning System, see the chapter on *Commercial Ventures*.

American Society of Clinical Pathologists

The American Society of Clinical Pathologists is marketing the first in an expected series of videodisc programs on the human organ system. The first of these modules covers lymph node pathology and is designed to help the physician diagnose diseases of lymph nodes.

The system assists the user by recommending features for which to look and tests to perform in order to solve the differential diagnosis. In addition to providing access to the large library of videodisc images, the program also provides a hypertext-style access to a textual information, including criteria for the diagnosis of the various diseases, immunology, molecular biology, and cell kinetics information. These capabilities are integrated into a mouse-driven system that can be used easily by people without any previous knowledge of computers.

The system was developed by Intellipath, of Santa Monica, California, over a five year period. Intellipath has plans to produce similar programs for each of the 40 organ systems in the human body.

American Medical Association

The American Medical Association (AMA) began developing videodisc programs on an experimental basis in 1982 under the direction of Leo Leveridge, M.D., then with the Department of Physician Credentials and Qualifications. The very first programs were created for the now discontinued Thomson-CFS transmissive videodisc player, and were driven using the North Star Horizon computer.

Within a year, the AMA had produced six programs covering topics such as Interviewing, Endoscopy, CPR, and Plastic Surgery. By 1984 Dr. Leveridge was working with Pioneer videodisc players, the inexpensive Radio Shack TRS80 Model 100 computer, and a bar code reader. Soon after this, however, the AMA decided to cease all videodisc development, and Dr. Leveridge retired to Bandon, Oregon where he still is active in the videodisc industry. The following are summaries of the programs developed by the AMA between 1982 and 1984.

Criteria for Design, Production, and Analytic Appraisal of Dynamic Audiovisual Materials

This program was developed in 1982 to enable educators to evaluate motion pictures and videotapes for the following criteria: 1) Use of the teaching potential of dynamic audiovisual media, 2) Choice of subject matter that is best learned by seeing it, 3) Camera mobility, and 4) Viewer orientation.

Critical Elements of CPR--Basic Life Support

Intended to replace the introductory lecture portion of a three-hour course for physicians in CPR, this 1982 program shows critical details of CPR. After each step of the procedure, the computer presents multiple-choice questions on the techniques and provides feedback based on the learner's answers.

Management of Facial Lacerations

Designed for use by physicians and medical students, this program presents a patient with a severely lacerated chin that is being repaired with commonly used techniques--some of which are satisfactory and others that are inadvisable. The viewer is asked to evaluate each technique.

Diagnosis and Management of a Pulmonary Problem

A joint effort by the AMA, the Nebraska Videodisc Design/Production Group, Pfizer Laboratories, and others, this 1982 program was developed for two purposes: 1) To explore the use of two sound tracks and branching for two different levels of audience, and 2) To see how well a stand-alone player (Level II) can be used in place of a microcomputer interfaced videodisc player (Level III). The program was made available in the early 1980s by the Nebraska Group, and was known as *The Intelligent Disc*.

Dysfunction of the Pharynx and Esophagus: Fluoroscopic and Endoscopic Findings

This program was developed in 1982 to provide instruction to physicians and students who are not familiar with the endoscopic appearances of the esophagus and who should refer patients for esophagoscopy when it is indicated.

Diagnosing Disorders of Deglutition

The purpose of this 1984 program is to alert non-specialists to the importance of adequately investigating symptoms of disorders of swallowing. The most interactive portion of the program consists of two brief diagnostic problems and an elaborate patient management problem. An accompanying workbook contains barcodes with which the learner uses a scanning wand to interact with the program.

American Association of Equine Practitioners

Although never actively involved in the development of videodisc instruction, The American Association of Equine Practitioners did provide film footage to Digital Equipment Corporation (DEC) in 1984 for a demonstration videodisc compiled by DEC. The

disc includes a segment titled *Operative Arthroscopy: Applications in Equine Lameness* in which the learner is taken through examination, diagnosis, and arthroscopic surgery on a horse's knee to remove a bone chip. Contributors of lesson material include the University of Georgia College of Veterinary Medicine and Cornell University College of Veterinary Medicine.

American Academy of Orthopaedic Surgeons

In 1986, the American Academy of Orthopaedic Surgeons, working with the National Library of Medicine, produced a videodisc program titled *The Chronic Unstable Knee*. The program is designed to provide both a Level I and a Level III resource for orthopaedic education as well as a vehicle for Continuing Medical Education in Orthopaedic Surgery (CMEOS). The Level I side of the disc contains approximately 5,000 images which make it possible to correlate cross-sectional anatomy with electronic images. Using the slow play and step mode of the videodisc player, a viewer may follow anatomical structures through the knee in three planes.

The Level III side of the disc consists of a patient simulation which provides the learner the opportunity to take history, do physical examination (using video segments), receive laboratory tests, order radiology, and perform diagnostic arthroscopy. All this may be done using a light pen and menus or free-text entry using the computer keyboard. The program is available for testing to health science schools by contacting the National Library of Medicine. (See *MedicalDisc Directory* entry for contact information.)

American College of Radiology

The *ACR Learning File*, the American College of Radiology's highly regarded reference library of full-sized teaching films, is under preparation in a new, complementary instructional medium. Beginning with the section on pediatrics, new and revised sections will also be issued on videodisc.

Each videodisc will include all of the images in the film version, a patient history, and a comprehensive discussion of radiographic findings, and detailed teaching discussions. Additional material may include differential diagnoses, protocols and descriptions for appropriate imaging procedures, images portraying disease manifestations in different patients, and pertinent bibliography. IBM/PC and Apple Macintosh versions are available for controlling all videodisc images on the video monitor and text displays on the computer screen. No separate imaging adapters or special hardware components are needed. All program and data files needed for control and display are included; monitors and accessories are available through ACR.

Laser Barcode. The ACR also is releasing a barcoded workbook with the Learning File series of videodiscs. LaserBarcode, developed by Pioneer Communications of America, offers a simple and effective way to access videodisc programs.

The system includes a book with text and barcodes, a laserdisc containing images, a standard TV monitor, and a Pioneer Laserdisc player equipped with a barcode reader. The book contains all text, charts and graphics included with the original film-based version of the ACR Learning File. Radiographic images are stored on a laserdisc and accessed from barcodes printed next to the appropriate text. Barcodes for general opera-

tion of the Laserdisc player the complete instructions are included. The barcodes reproduced above contain commands to search for a specific frame, play a video sequence, or simply step to the next frame. All control commands can be executed through barcode.

Pediatric Videodisc

The American College of Radiology is offering the revised Pediatric Section of the ACR Learning File on videodisc. This section includes investigative techniques such as: magnetic resonance imaging, ultrasound, computed tomography, nuclear medicine, general diagnostics, and special procedures and their application to specific pediatric conditions.

The section contains 275 cases divided into seven subsections: Newborn Chest (31 cases), Chest (45 cases), Skeletal (55 cases), Gastrointestinal (38 cases), Genitourinary (30 cases), Neurology (41 cases), and Cardiovascular (35 cases). Each case has been selected and organized to provide both a clinical experience in pediatric radiology interpretation and a logical educational sequencing. Eight cases have been added to the cardiovascular subsection on this videodisc version. They made extensive use of the videodisc's ability to show full motion along with still images.

Chest Videodisc

The American College of Radiology also is offering the revised Chest Section of the ACR Learning File on videodisc. The section is divided into eight subsections: Basic Principles (56 cases), Diffuse Pulmonary Disease (61 cases), Segmental Lobar Disease (41 cases), Solitary Nodules (19 cases), Cavities (22 cases), Free Fluid/Air (24 cases), Cardiovascular Disorders (54 cases), and Mediastinal Masses (35 cases). Imaging techniques such as magnetic resonance, nuclear medicine, and state of the art computed tomography, have been included. This new edition contains 158 new cases, including a dramatic review of segmental lobar collapse by Dr. Robert Heitzeman of SUNY, Syracuse. As in the entire ACR Learning File, the cases have been selected and organized in a manner that will provide a logical and effective learning experience.



Chapter 9

Testing & Certification

Although little use is being made of videodisc systems for testing and certification, the potential of the technology for such purposes is tremendous. With the ability of videodisc systems to simulate medical situations, they not only are ideal for training and education but for assessment as well. The most significant development in this area is taking place at the National Board of Medical Examiners in Philadelphia, where a computer and videodisc component may soon be added to the examination leading to licensure for U.S. and Canadian medical school graduates. After this system is successfully implemented, many other certifying and licensing organizations are sure to follow suit.

National Board of Medical Examiners

The National Board of Medical Examiners (NBME) has incorporated videodisc technology into its Computer-Based Examination (CBX), a new examination tool being developed for future use by the NBME. CBX is an interactive clinical simulation developed by the NBME that will be administered using regional evaluation and learning centers equipped with networked microcomputers and videodisc players.

CBX represents the result of the NBME's 18-year research effort to develop clinical simulations to evaluate physician competence. The current CBX model emphasizes patient management and dynamically responds to the movement of time. Field trials of CBX have demonstrated its validity and reliability in the assessment of physician competence.

The CBX will be used as a major component of the final NBME examination leading to certification and licensure for approximately 13,000 U.S. and Canadian medical school graduates each year. This use represents a major advance in assessment of clinical competence, adding a new dimension to the elements of competence objectively evaluated. The NBME expects that computer-based testing will also be used widely in other licensing and certifying examinations, as well as in self-assessment programs.

The widespread application of simulation technology in the evaluation of physician competence is likely to have several beneficial effects. First, the use of simulation in medical education will be encouraged by the use of simulation in the evaluation process. Second, observation of clinical performance in standardized clinical situations will be possible for large numbers of individuals for the first time. Third, the ability to assess physician competence will be greatly enhanced. Finally, availability of a computer-based delivery system for CBX will encourage the development and use of other innovative computer-based methods in the evaluation of physician competence.

NBME Plans for Computer-Based Testing

In 1987, the NBME conducted a major field study of the CBX system and, as a result, has "further clarified the measurement characteristics and confirmed the value of computerized patient simulations in the assessment of clinical competence." The NBME is now making the CBX program available to selected medical schools for further evaluation. Applications have been solicited from schools, and will be selected on the basis of their program description, willingness to provide appropriate support for the CBX system, and payment of a license fee of \$1000.

The selection of schools for further use and testing of the CBX was the first of four phases designed to bring the program to the point where it can be implemented in the NBME examinations. During Phase One, the NBME provided participating schools with copies of the CBX program, orientation material, computerized feedback questionnaires to obtain user feedback after a CBX session, and continued technical support through the use of a direct telephone line to the NBME.

The second phase began in late 1988 when subject tests were offered to participating schools. These subject tests, consisting of selected CBX cases and multiple choice questions (MCQs) for clinical disciplines, will be made available for further study and will be administered only at participating schools. Additionally, some schools were selected as prototypes for future authorized testing centers.

Phase Three began in 1989 when fully-developed tests were offered to participating institutions for intramural evaluation. Schools were selected for designation as authorized testing centers. In Phase Four the CBX will be implemented in NBME examinations using authorized testing centers.

CBX Today

The CBX consists of patient simulations which are presented in an uncued patient management environment. The student is presented with a brief description about the condition, circumstances, and chief complaint of the simulated patient. Subsequent information about the patient depends on the student's requests for tests, procedures and/or therapies. The student is expected to diagnose and manage treatment and to monitor the patient's condition as it changes over time and in response to treatment. Over 2,000 diagnostic and therapeutic actions are possible, which the student requests by typing in orders on the computer keyboard. The results of some tests are provided using medical images from a linked videodisc.

The computer maintains a record of every action requested by the student. This record is then compared to a scoring key, which consists of actions that a committee of experts identifies as being beneficial or harmful (risks) to the patient. For initial use in medical schools, cases have been modified to compare student actions with scoring key actions at the end of each case.

There are five sets of five cases each available, and one set of eight multidisciplinary cases. The case subjects include Pediatrics, Internal Medicine, Surgery, OB/GYN, and Family Practice.

CBX Pilot Test Results

CBX was recently evaluated in a large pilot test involving 200 residents and 75 students in Chicago and Philadelphia. Each learner was administered seven cases and 140 multiple choice questions over two full days of testing. The test results were compared with MCAT scores, NBME Part I, Part II, and Part III scores, the 1987 Part III PMP (patient management problems) scores, and the rank ordering of program directors. The results were reviewed by an independent advisory panel (comments found in Chapter 16, Videodisc Research/Surveys).

Based on currently available evidence, the NBME feels the CBX is a testing method that meets both psychometric and logistic criteria for use in large-scale testing programs. Therefore, they feel it is likely that the method will prove useful in assessing competence of physicians. While several important questions have not yet been fully answered, information from the pilot testing has allowed the NBME to make the following conclusions:

Prior Computer Experience. Neither prior computer experience nor computer anxiety influences examination performance for residents. Using a survey to quantify prior exposure to and experience with typewriter keyboards and computers, a computer experience score was developed for each student and resident. Using the Computer Anxiety Index, pretest anxiety state was assessed. State of anxiety was also assessed utilizing adjective checklists. These subject characteristics were compared with performance on the CBX portion of the pilot exam. These analyses showed that residents' test performance was uncorrelated with computer experience (0.09), computer anxiety (-0.07), and the level of pretest anxiety (-0.04). In the smaller student group, the correlation between CBX performance and computer experience was higher (0.27), approaching significance at the 0.01 probability level. The explanation for this apparent difference between the student group and the resident group needs further exploration.

Standardized Test Conditions. Test conditions need not be standardized. The pilot examination was conducted at two sites. In Philadelphia, a carefully controlled testing center optimizing ergonomics of the examination environment was utilized. In Chicago, a temporary facility was constructed with little attention to ergonomic details. Chicago and Philadelphia residents did not differ in ability, nor did the difficulty of the scoring elements vary between the two locations.

Practice with CBX. Considerable practice opportunity must be provided before use of CBX for testing. Two forms of the CBX portion of the examination were given to random halves of the pilot exam sample. The first and last two cases were interchanged on the two forms. Comparison of performance on the simulation that differ only in their position in the examination allowed an assessment of learning effect on examination performance. Three of the four cases and their individual elements were more difficult for examinees when they were positioned early in the exam. While the amount of practice effect seems to be somewhat determined by the nature of the simulations encountered early in the exam, it is clear that experience with four or five simulations is required before performance will stabilize. In surveys of pilot exam participants, only 13 percent of examinees were comfortable with the mechanics of the CBX model after the orientation and practice case, while 72 percent were comfortable after the second case and nearly all were comfortable after four or five cases.

CBX Reliability. While CBX precision of measurement is equal to that of patient management problems (PMPs) when time is held constant, a single day of testing will not be adequate to reliably assess all examinees. Using eight CBX cases, required six hours of testing time, an alpha reliability of 0.75 was attained. In combining eight CBX cases with 280 multiple choice questions (the current Part III MCQ length), the expected reliability of a linear combination would be 0.82. In assessing performance of the instrument in the pass/fail range, the standard error of measurement (SEM) for residents straddling the fifth percentile was 0.50 standard deviations. While this data suggests that a two-day examination would be required to reach a combined reliability of 0.9, alternate strategies that might reduce this time include better targeting of the simulation and sequential testing, administering larger numbers of cases only to those examinees whose performance falls at the bottom of the distribution on a screening set of cases.

CBX measures something different from PMPs and multiple choice questions (MCQs). Analyses of correlations, factor analyses, regression analyses and "pass/fail" analyses all confirmed a difference between what is measured by CBX and other methods. PMP and CBX correlated 0.33 with each other. When PMP risk and benefit scores were combined to maximize their relationship with CBX, the correlation increased to only 0.34. When corrected for attenuation, these correlations are approximately 0.56. MCQ and CBX correlated 0.37 with each other. When corrected for attenuation, this correlation is 0.49. A factor analysis of MCAT, Part I MCQ, Part II MCQ, Part III, CBX and PMP scored produced three factors: Part I/Part II, MCAT and Part III. CBX did not fit in easily with any of the three factors, but has its highest loading with the Part III factor. Interestingly, CBX loaded more highly with the Part I/Part II factor than did PMP. In this analysis, the three factors which emerged explained 22 percent of the variance in CBX and 51 percent of the variance in PMP. Finally, when a theoretical pass/fail line is drawn at the fifth percentile of each group, there is substantial disagreement between CBX and PMP in classification of differences in the trait being measured or to the inherent imprecision of both measures.

Resident Specialty. There is no consistent effect of resident specialty on CBX performance. It has been shown that there is a strong specialty effect on MCQ items in Part III and a weaker specialty effect on PMPs. In CBX, two of the cases in the pilot exam showed noticeable specialty effect. Other cases, including cases in the same specialties as those with demonstrated specialty effect, showed no difference. More study is needed to determine the characteristics of a case that result in a specialty effect.

Computerization of MCQ Items. Computerization does not affect difficulty of MCQ items. Difficulty of items presented by computer did not vary from the difficulty of the same items when presented in the written Part III examination. Computer administered MCQs were answered more quickly than written MCQs, and residents expressed a marked preference for administration of MCQs by computer.

Computerization versus Written Testing. Residents and students prefer computer administered examinations to written examinations. In questionnaires administered at the end of the examination, residents preferred computer-based simulation to written simulation by a 3:1 margin, and students preferred computer administered simulations by a 9:1 margin. In expressing preference for administration of the NBME Part III examination, residents preferred computer administration by a 2.4:1 margin, and students by a 7:1

margin. Residents found CBX to be as fair a measure of clinical knowledge as MCQs. Residents preferred computerized patient simulations to written simulations or MCQs as valid assessments of overall clinical competence. Students have similar preferences, but more strongly in favor of computer administered tests.

CBX Field Testing.

The National Board of Medical Examiners has begun testing their new Computer-Based Examination (CBX) at 70 medical schools nationwide. The exam includes multiple choice questions identical to those currently administered in the Part I, II, and III paper-based exams. In addition, the CBX includes an open-ended videodisc-based simulation that is designed to provide an uncued test of patient management skills.

Each participating school or test site was required to purchase three delivery systems, each consisting of an IBM-PC XT or equivalent, and either a Pioneer LD-V6000 series, Sony LDP-1200, or LDP-1500 videodisc player. The videodisc simulation portion uses a two-screen presentation method which eliminates the need for video overlay and keeps the cost per system at about \$2,500.

While the entire CBX is still in a research phase to evaluate its effectiveness, the multiple choice part will be certified soon as a standard part of the exam process. The simulation will require additional research to determine the validity of scores for the open-ended procedure.

During 1988, 16,703 people took the part I exam, while parts II and III each were taken by more than 13,000. Stephen Clyman (CBX project director) sees the potential for multiple systems to be installed at each of the 144 medical schools in the US and Canada, with at least two sites per state.

Feedback from Test Sites. The NBME has collected and released summary evaluations provided by 23 of the CBX testing sites. A review of some of these results is provided in the chapter entitled Videodisc Research/Surveys.

National Council of State Boards of Nursing

The National Council of State Boards of Nursing (NCSBN) is working with the National Board of Medical Examiners (NBME) to develop simulations to test decision-making skills of candidates taking the National Council Licensing Examination (NCLEX). The Clinical Simulation Testing (CST) model, being developed with a \$1.86 million grant from the W.K. Kellogg Foundation, will use the same design as the NBME's Computer-based Training model to evaluate nursing decisions related to assessment and interventions.

The CST model is not being developed to ask the candidate how to do a procedure or how to implement nursing care, but rather to evaluate the decision to give care. The decisions to be evaluated relate to assessment and intervention. The candidate will be presented with patient data and will be asked to make decisions regarding the patient using a free-entry system designed to be non-cueing.

During the course of the simulation, candidates will be able to gather information on the patient from four sources: 1) "patient" interviews, 2) physical examination of the patient, 3) existing documents such as the patient record, and 4) interviews with the patient's family, friends, or other health professionals. Intervention will be selected using

a menu which includes verbs such as administer, monitor, perform, omit, continue, and counsel. After selecting a menu item, the candidates enter what it is they want to do in relation to the verb that they have selected.

The simulation will use a free-entry input where the users will type their requests into the computer using English language words (e.g. "monitor blood pressure"). Unlike menu-driven simulations where users must pick from a list of pre-selected options, natural language text entry allows users more flexibility to make their own choices regarding assessment and intervention. However, according to Carolyn Yocum, principal investigator, one of the major obstacles using this approach is the lack of standardization in nursing terminology. In order for this system to work, a lexicon must be developed for the computer that will recognize entries made by candidates from different environments. In other words, the developers must anticipate all of the possible terms that will be used by these candidates.

American Academy of Orthopaedic Surgeons

In 1986, the American Academy of Orthopaedic Surgeons, working with the National Library of Medicine, produced a videodisc program titled *The Chronic Unstable Knee*. The program is designed to provide both a Level I and a Level III resource for orthopaedic education as well as a vehicle for Continuing Medical Education in Orthopaedic Surgery (CMEOS). The Level I side of the disc contains approximately 5,000 images which make it possible to correlate cross-sectional anatomy with electronic images. Using the slow play and step mode of the videodisc player, a viewer may follow anatomical structures through the knee in three planes.

The Level III side of the disc consists of a patient simulation which provides the learner the opportunity to take history, do physical examination (using video segments), receive laboratory tests, order radiology, and perform diagnostic arthroscopy. All this may be done using a light pen and menus or free-text entry using the computer keyboard. The program was recently tested at various medical schools across the country. Results of the testing should be available in 1990.

Northeast Regional Board of Dental Examiners

The Northeast Regional Board of Dental Examiners (NERB) is developing a videodisc that they expect to be a wide-ranging educational resource in dentistry and dental hygiene which will help insure that dental education and licensure testing are congruent with each other. The project is tentatively titled *The Encyclopedia of Dentistry* and is intended to help bridge the gap between the varying curricula taught in the schools and the candidate's level of dental comprehension and performance required by the licensure board. NERB believes that the *Encyclopedia* may help to make dental curricula and licensure testing more consistent with each other by providing an educational resource in dental education which is entirely consistent with NERB's licensure criteria.

Because the *Encyclopedia* will provide licensure candidates with a thorough review of the procedures, requirements, and content area of the NERB examination, NERB expects schools to purchase the program to, at the very least, help students do well on the NERB examinations. A second purpose of the *Encyclopedia* will be to help encourage schools

to create other curricular materials which are interactive and computer-based, and thus help to convince dental educators to begin using interactive video within the curriculum.

The *Encyclopedia* also will contain an examiner training component designed to insure that all of the 280 NERB examiners fully understand the established criteria and procedures of the NERB examination. Finally, those involved in the project believe that the *Encyclopedia* may serve as a prototype for a future interactive NERB examination.

NERB Background. For the past 20 years, NERB has written and administered licensure examinations in the professions of dentistry and dental hygiene for 15 northeastern states, a consortium which licenses approximately half of the country's dental practitioners. Graduates in these states are required to pass the two parts of the National Dental Boards as well as the more clinically-oriented NERB examination in order to obtain their license to practice. The NERB battery of three simulated and two practical examinations serves roughly the same purpose as the third-year board exam in Medicine. Upon passing these exams, the successful candidate is free to practice in any state within the consortium.

The NERB examination battery consists of two general types of examination: clinical exams in which candidates actually perform dental work on patients, and simulated exams consisting of slides and multiple choice questions. The *Encyclopedia* will provide images and text-based information across all of the disciplines covered by both types of NERB examinations. The exams are given three times a year in 30 dental schools throughout the country. Each year NERB examines approximately 2,200 candidates in dentistry and about 2,000 candidates in dental hygiene.

The Encyclopedia of Dentistry. The *Encyclopedia* will consist of an interactive computer program with a supporting videodisc able to provide a vast range of dental information across 12 disciplines in dentistry. The program will run on IBM-compatible or Macintosh microcomputers coupled with a videodisc player, and will be programmed for both two-screen and single-screen systems. The videodisc will contain about 9,000 still images and approximately 15 minutes of motion video in support of the text information provided by the computer.

The official start date of the Encyclopedia project was March 1, 1988 when Lunaria, Inc. was hired to prepare the preliminary design for the project. The Project Director is Dr. Charles Cartwright who is providing management and supervision over 10 content authors, each of whom are writing the text and creating the image base for each of the 12 disciplines. Other primary parties essential to the project are Dr. William K. Collins who manages project funding, the NERB examiners who have contributed the primary funding, and Dr. John M. Straub who is the coordinator of videodisc production. The project is projected to be completed by January 1, 1991.

Memory Assessment Clinics

Memory Assessment Clinics (MAC) in Bethesda, Maryland is using videodisc technology to simulate actual tasks of daily life in which memory deficits are apparent. These tests are used to identify memory pathology associated with disorders such as Alzheimer's disease, and to assess the effects of experimental drugs designed to improve memory in humans.

The tasks assessed involve everyday functions such as 1) recalling the names of individuals following introduction, 2) recognizing faces that were previously seen, 3) placing objects within a house and recalling their location, 4) retracing a route driven through an urban area, 5) recalling telephone numbers, and 6) recalling the content of television news broadcasts. Although these and other MAC tests are conceptually straightforward, they are technically quite demanding. Without interactive videodisc technology, many of these tests could not be developed.

To perform these tests, MAC designed a system which consists of an AT&T 6300 computer, AT&T Image Capture Board, Sony PVM-1911 monitor with built-in touch screen, and a Panasonic TQ 2024 videodisc player. The Panasonic was chosen because the DRAW (direct-read-after-write) technology allows frames to be added to existing test programs without the need to master a new disc each time a test is refined.

The tests developed by MAC are being administered to several hundred volunteers and to large numbers of patients with specific memory disorders. Data from this effort will permit the early identification of persons with degenerative disorders. MAC is also conducting a service of studies with drugs designed to enhance memory. In these studies, interactive videodisc tests provide direct measures of drug efficacy.

Chapter 10

Museum/Public Exhibits

For the same reasons interactive videodisc technology is particularly well suited to use as commercial exhibits for pharmaceutical companies, it is also being used successfully by museums and other institutions for public exhibits. Interactive videodisc kiosks grab users' attention and allows them to explore any topic in-depth at their own pace.

Academy of Osteopathic Medicine

Conceived as a science museum exhibit, *The Doctor Is In* is designed to present a positive image of osteopathic medicine and to increase public awareness of the profession. Funded by the Auxiliary to the Central Ohio Academy of Osteopathic Medicine, the Academy itself, and the Ohio University College of Osteopathic Medicine, the program presents information in a friendly, realistic manner that is engaging and understandable for children and adults.

The exhibit consists of two interrelated sections, a video kiosk and an information kiosk. The video kiosk presents a familiar television screen, three simple buttons, and two telephone earphones along with speakers. The information kiosk has a large, movable wheel printed with an image of Da Vinci's Universal Man surrounded by a series of questions about osteopathy, health, and the body. The wheel can be rotated and answers to the questions are presented in two windows on the circumference of the wheel. While one or two persons are watching the program on the video kiosk, others can be learning by using the wheel.

A continuously playing loop of animated graphics invites people to press a button and start the program. When started, a doctor appears behind his or her desk, addressing the viewer and explaining why he or she choose to be an osteopathic physician. Each time the program starts, the character of the doctor is switched between male and female to reduce sex stereotyping. The doctor concludes the 30 second introduction by inviting the viewer to help out by pressing a button and joining the doctor in seeing some patients. At this point the viewer sees the program from the doctor's point of view.

A nurse enters and gives the viewer a brief description of the three patients in the examination rooms: 1) a young girl with an earache, 2) a teenager with an athletic injury to her knee, and 3) an older man who is complaining of shortness of breath. The viewer selects a patient and enters the examination room to take a history, perform the exam, make a diagnosis, and perform appropriate treatment.

Boston Museum of Science

Visitors to the Boston Museum of Science are now able to decide the fates of four people in a local bar--and learn about the responsible use of alcohol in the process. *Ben's Grille*, co-sponsored by Multiplan Health Plan and the Boston Museum, was developed to give people factual information about the dangers of alcohol abuse in an interesting and fun way. It is the first exhibit to use interactive videodisc technology to inform people about the dangers of alcohol abuse.

Ben's Grille educates people in a way that is both involving and fun. Produced by Century III Teleproductions of Boston, the exhibit is housed on the second floor of the museum. *Ben's Grille* looks like a cozy neighborhood lounge, except that video screens sit on the bar. By touching the screen, the viewer meets Ben, the bar's owner, who introduces four characters. Ben challenges the viewer to make decisions about how much each of the characters has to drink in the course of one evening. The consequences of those decisions are revealed as the story progresses.

For example, the bar's singer, a reformed alcoholic, is singing before an important agent that night. Periodically, her story stops and the viewer is asked if she should have a drink. The success or failure of her evening depends on the choices the viewer makes.

"We've learned that very few people are fully informed about the proper use of alcohol," said Dr. Thomas Peebles, Chairman and Chief Executive Officer of the MultiGroup Health Plan. "We are proud to pioneer an approach that supplies the right information in an entertaining but memorable way." Peebles also said plans are being made to bring *Ben's Grille* on tour sometime in the future. "For example, we would like to be able to bring the technology into the classrooms," he said. "We're excited about using this as a new teaching tool."

Cell Biology

The *Cell Biology* videodisc was designed and produced by the Boston Museum of Science as a component of a Cell Biology exhibit which opened in December 1982. Traditionally, the subject matter of this exhibit lends itself to display techniques such as photographs, diagrams, and perhaps a view or two through a microscope. According to Larry J. Ralph, head of the Physical Plant & Technical Services, the museum wanted to encourage more visitor involvement than the traditional media would have allowed. Therefore, several hands-on models, devices, and magnifying systems were devised to teach about the properties and behavior of single celled organisms. Additionally, a new approach to the visitor involvement problem was chosen, this being the interactive videodisc technology.

The project was the Museum's first experience with videodisc production. With a relatively low budget, but time to permit experimentation, they took the leap into researching playback hardware, input device configurations, and videodisc software design. Video images were obtained from several of the top microscopists in the country along with footage filmed by museum staff through its own Zeiss microscope. Original background instrumental music was recorded in house. All pre-production editing was done in house on their 3/4-inch editing system. Final editing, including character generation for text and 1-inch conversion was done at the facilities of WGBH-TV in Boston.

The original exhibit design included only one interactive video component: a menu driven program on cilia. Also included in the exhibit were four linear play video segments. These were recorded on the disc to eliminate the need for maintenance-prone videotape players in the exhibit. These segments consisted of programs on heart cells, amoebas, and mitosis, in addition to an animated introductory sequence. Subsequently, a second interactive station was incorporated with programs that included a multiple choice quiz on cell activity and a menu-driven image library of video footage of cells in action. Both of these programs were developed from the "extra" video material that had been recorded during the research and production phases of the project.

Although future videodisc projects at the Museum would use touch screen technology, because of cost limitations, interactivity in this exhibit was achieved through a visitor interface consisting of a numeric keypad and a program restart button. All program control software for this Level II program was input manually into the memory of the Sony LDP-1000 videodisc player (rather than encoded onto the disc itself). This manual method of programming permitted the exhibit to be altered several times during the formative evaluation stage of the project. By using the videodisc player's own microprocessor, no additional computer hardware was required. Recognizing the potential for program alterations, dozens of alternate title, response, menu, and instructional screens were character-generated and recorded on video during the post-production phase. These images later provided the needed structure for future program changes.

"Although the image library on the disc is a spectacular reference," says Ralph, "so were the lessons learned in interactive videodisc production." The Museum has since been involved in the production of five other videodiscs covering a variety of topics from water resources to alcohol abuse.

California Museum of Science & Industry

As part of a permanent nutrition exhibit at the California Museum of Science and Industry, visitors can "order" a televised meal at the counter of the *Interactive Diner*. The program is one of eight stations in the "Health For Life" exhibit. The other stations include Pulse & Blood Pressure, Balance, Health Habits, Input/Output (dealing with caloric input and activity level), Height & Weight, and Healthy Heart. The visitor is given a magnetic card which records the scores at each station. At the end of the exhibit, the participant is provided with a personal health profile.

Interactive Diner is part of the Nutrition station and is located in a diner setting complete with a counter and bar stools. The visitor is greeted with a video monitor which asks "Hungry? Touch Here". Flo the waitress explains how the interactive diner works and then presents the participant with six menu categories including Hot Food, Drinks, and Desserts. Each of the six menu categories lists six food item from which the participant selects. After each selection, Flo comes on the screen with comments regarding the nutritional value of the selection. In order to prevent one person from tying up the exhibit too long, participants are limited to two items per food category. The program was produced by Wetzal Associates and programmed by New England Technology Group.

Healthcare Professions Exhibit

Another videodisc exhibit produced for the California Museum of Science & Industry is *You Decide*, a program designed by Wetzel Associates of Boston, Massachusetts to provide a museum exhibit that presents current issues in the healthcare professions. This program consists of a series of 45 second vignettes presenting a situation with multiple solutions. An example is concerns two neighboring hospitals which each have occasional need of a CAT scanning unit. The viewer is asked to select from a selection of possible solutions, in this case whether both hospitals should share the cost and use of one unit, each buy their own units, or one or the other buy their own. The answer is the one tabulated with the answers given by all previous viewers and the updated percentage of all choices is shown the viewer.

Chicago Museum of Science & Industry

The Chicago Affiliate of the American Heart Association recently renovated its heart exhibit hall at the Museum of Science and Industry in Chicago. The hall, refurbished at a price of nearly \$2 million, includes five interactive videodisc-based game systems. A sixth unit is maintained as a backup.

Haukom Associates of San Francisco developed the interactive videodisc portion of the overall project. The five game systems deal with the topics of heart disease risk and prevention. *The Beat Goes On* allows the visitors to input their birth dates and then displays the number of times their hearts have beaten during their lifetimes. *Chances Are* assesses the player's risk of heart disease and outlines steps to prevent heart attacks. *Daily Changes* lists twelve common activities and reveals why they raise, lower, or have no effect on blood pressure. *Make a Heart Beat* takes visitors through a journey of the heart and circulatory system. Finally, *Cook it Right* allows the visitor to cook a meal on video, selecting ingredients and preparation methods. The system displays the fat, sodium, and andol content of the finished dish and allows the user to revise the recipe to make the meal more healthful.

Diner Disc II

Diner Disc II, a program designed by Wetzel Associates to teach the public about general nutrition, is installed in the Chicago Museum of Science and Industry. Based on the *Interactive Diner* exhibit in the California Museum of Science and Technology, *Diner Disc II* is housed in a kiosk within the "Healthworks" exhibit in Chicago. The Chicago version is customized to the geographic area with regional food choices such as baby back ribs, white fish, and brautwurst. *Diner Disc II* also has two stations (instead of one) which are manned by a waiter and a waitress. Each station has six food groups with six additional food items per group, for a total of 72 items. With some menu selections, the waiter or waitress may "interact" with the other videodisc station by asking if they have a particular item. The end of the program presents a "Nutritional Bill" to the participant which provides a nutritional breakdown of the items ordered.

Mental and Emotional Health

Another videodisc exhibit developed for the Chicago Museum of Science & Industry is the *Joyce Disc*. Designed to provide a museum exhibit on mental and emotional

health, this program is also part of the "Healthworks" exhibit. The program uses film vignettes depicting various commonplace situations and dilemmas. The viewer may select which vignette to view using a keypad. Following each vignette, which run approximately 45 seconds, the viewer is presented with a multiple choice of "what to do." After making this choice, the viewer is presented with a short video presentation where Dr. Joyce Brothers comments on the situation and the viewer's choice of action.

The Franklin Institute

The Franklin Institute has produced a museum exhibit to illustrate the different medical imaging techniques to the public. Part of a larger exhibit on Life Sciences, this program includes information on six imaging techniques: X-ray, Ultrasound, CAT Scan, MRI, Nuclear Imaging, and 3-Dimensional Reconstruction. One part of the program permits viewers to see imaging samples from each of the six methods for the human head, heart, and spine. Another part of the program allows the visitor to see a one-minute video segment on each of the imaging techniques, which includes information on their use in medicine.

The program plays on a Sony LDP 1500 videodisc player with Apple IIe computer and a proprietary interface. The Medical Imaging program is available for purchase as a hardware/software package from the Franklin Institute.

Healthdisc

Richard Rush Studios, working with Alexander Design of Chicago, has developed the *Healthdisc* exhibit to provide a visual database on health topics for clients to use in presenting health information. The disc will be used in privately-funded "health education centers" having museum-quality exhibits which are available to public schools and other community groups. Disc content is based on Encyclopedia Britannica filmstrips and films. Topics include drug abuse prevention, teen pregnancy, AIDS, nutrition, safety (including sports safety), dental health, behavior, growth, family living, and human biology. The first application will be at the Roper Mountain Health Education Center in Greenville, North Carolina.

Milwaukee County Zoological Gardens

The Calcium Bone-Builder Exhibit was developed by Alexander Design of Chicago for the Zoological Society of Milwaukee County to provide practice in identifying foods with calcium content in a museum exhibit game. The exhibit is installed in the Dairy Education Complex of the Milwaukee County Zoological Gardens. A proximity detector changes the exhibit display from an attract mode to a welcome mode when the exhibit is approached. The program is designed as a game format in which pairs of food items are displayed and the user selects the item which has a higher calcium content. An image of a skeleton grows when correct answers are chosen. Difficulty level adjusts on the basis of user responses, with more challenging food pairs presented when most of the user's answers are correct. Program options are selected by moving a "bone" on the front of the display.

Molson Ontario Breweries

Molson Ontario Breweries, with design and production assistance from the Association of Colleges of Applied Arts and Technology of Ontario and the Clinical Research Institute of Montreal, have completed a traveling exhibit called *Speakeasy*. The purpose of the exhibit is to foster the responsible use of alcohol by young adults between 19 and 25 years of age. This is done by circulating the program in a special kiosk among colleges and universities in Canada.

First launched in Quebec in 1985 as "Le Bar Ouvert", *Speakeasy* simulates a conversation between a bartender and the user. Chosen for its double role as a natural confidant and familiar alcohol provider, the persona of "Zack" the barman is clearly not in a position to moralize on the subject. As such, his credibility remains high. The simulation process makes it possible for the user to influence the way the conversation develops, based on the individual characteristics expressed in answers to the bartender's questions.

Chapter 11

Health Promotion

This year, more than \$100 billion will be spent by U.S. corporations on medical care costs for employees and their families—an average of more than \$1,400 per employee. In the same year, employee absenteeism, due to illness or injury, will account for hundreds of billions of dollars more in lost productivity. Companies are fighting back with health promotion programs, a simple solution with a proven track record. By changing the lifestyle of their employees, big business is saving big dollars by reducing both medical expenses and insurance premiums. At the same time, an increased emphasis on the prevention of drug and alcohol abuse has led to the development of interactive video programs for school-aged children.

Corporate Health Promotion

A few years ago, corporate health promotion programs were scarce. Today, few large corporations would be without them. Numerous programs have sprung up around the country providing health promotion services which offer health risk appraisals for employees, followed by classes which address exercise, smoking, weight control, cholesterol, stress, and alcohol use. These programs have been shown to cut absenteeism, reduce medical claims, and lower insurance premiums—resulting in a substantial cost savings to employers.

Although corporate health promotion programs focus on the full range of concerns, one of the most common areas to address is stress management. According to studies conducted by the American Academy of Family Physicians, two-thirds of office visits to family doctors are prompted by stress-related symptoms. The loss of productivity due to worker absenteeism alone (much of which is attributed, directly or indirectly, to stress) have been estimated at \$50 billion to \$75 billion a year, or more than \$750 per worker.

A representative of Time, Inc., which markets video-based wellness programs through Time Life Video, says,

"Stress management training has become a major concern in large corporations. We [Time Life] estimate the market for such wellness programs to be between \$500,000,000 to \$1,000,000,000 per year for "off the shelf" programs and outside seminars. We also estimate this market to be growing at 30 to 50 percent annually."

A Growing Market Opportunity. Health promotion programs are a relatively new concept, one with a lot of room yet to grow. In an attempt to assess the role of interactive programs in the delivery of health promotion information, SK & A Research surveyed

almost 1,000 U.S. corporations of all sizes. Nearly 80 percent of these companies reported that they are planning, testing, monitoring, or currently developing some aspect of automating their health promotion through the use of interactive videodisc, video tapes, or personal computer software applications.

Given the overall growth and concern in these corporations about health promotion programs, it appears there is a significant market opportunity for the sale of well designed videodisc programs. SK & A Research forecasts that the number of U.S. Corporations using interactive systems for health promotion programs will grow from about ten in 1985 to 750 by 1990. Although this figure seems optimistic considering the slow growth of the videodisc industry as a whole to date, the components found in health promotion programs (risk-assessment, smoking, exercise, stress, etc) are relatively stable topics which lend themselves well to "generic" programs. This means they are suitable topics for wide audiences and mass distribution, a key component for videodisc programs to be financially successful.

Among those companies interested in providing health promotion programs are the carriers of corporate health insurance. Companies such as Travelers and Metropolitan Life have shown a strong interest in promoting the concept of corporate health promotion.

Center for Corporate Health Promotion

The interactive video program *HealthTouch* was created by the Center for Corporate Health Promotion (CCHP) to disseminate information within three major environments: corporate benefit departments, hospitals and worksite health promotion programs, and upscale health club facilities. It allows health professionals to spend more time conducting seminars, developing new programs, and providing individual assistance and counselling. In turn, it provides benefit managers a means of integrating benefit information within a proactive self-care strategy.

In the past, CCHP has used linear video in their Focus programs which target lifestyle issues such as weight control. In making the move to videodisc, CCHP decided to cover three major areas--Common Complaints (based on the popular book *Take Care of Yourself: A Consumers Guide to Medical Care*, co-authored by CCHP President Dr. Donald M. Vickery), Lifestyle Management, and Health Assessment. Common Complaints covers the management of sprains, breaks, strains, sports-related injuries, childhood diseases, skin diseases, heart attack, lower back pain, and ears, nose and throat. Lifestyle Management includes weight control, exercise, smoking cessation, alcoholism, and stress management. The Health Assessment contains LifeScore, CCHP's health risk appraisal, which identifies the user's high risk areas.

There are several unique features of the *HealthTouch* kiosk:

Medical Self-Care. This selection of the program is a "computerization" of the popular medical self-care book *Take Care of Yourself* that adapts 99 clinical algorithms for managing common medical complaints.

LifeScore. A personalized health risk appraisal helps people determine their health status and get started on improving their health and longevity. LifeScore provides instant feedback and allows people to do "what-if" modeling, such as "What if I stopped smoking?" or "What if I cut down on my alcohol consumption?"

Exercise/Aerobics. Demonstrations of health club equipment and exercises/aerobics are performed with slow motion play of the laserdisc and are accompanied by detailed text.

Health Education Track. Self-directed instruction on topics such as exercise, smoking cessation, stress, nutrition, alcohol/drugs, and AIDS are included within this menu feature.

Customized Information Center. This feature permits the sponsoring organization to download and upgrade specific information such as activity schedules, self-help resources, benefit information, and membership.

The concept design for *HealthTouch* began in March 1987 and delivery was completed in early September 1987. Design and production was performed by the Travelers Interactive Video Group with project costs of approximately \$55,000 plus an estimated \$60,000 internal man-hours for data processing and design work. Authoring was done using IBM's InfoWindow Presentation System (IWPS); PC graphics were created using PC PAINTBRUSH PLUS by Z-SOFT; and artificial intelligence interface was accomplished with 1ST CLASS by Programs in Motion.

University of Illinois-Chicago

With support from Metropolitan Life, The Center for Educational Development at the University of Illinois in Chicago has developed a videodisc titled *Back Stress and Body Alignment*. The program was designed to demonstrate the potential of interactive videodisc technology for raising health awareness among the general public and to determine the cost and feasibility of such productions.

In the program, the viewer may explore lessons on anatomy, motion, balance, strength, flexibility, disease, diagnosis, and prevention. The segments are structured around the demands of modern life and include practical hints to consider in selecting furniture, buying proper shoes, exercising, lifting, and driving. In addition, the program offers background information and bibliographical references for viewers who wish more information on the subject.

Adolescent Alcohol and Drug Education

In the last few years, drug and alcohol abuse has come to the forefront of public awareness. As a result, public and private funding of drug and alcohol education programs has dramatically increased. Most of these efforts have focused on the adolescent population. The following are two such projects.

Adolescent Center for Education

Adolescents and Alcohol is the first videodisc produced by the Adolescent Center for Education (ACE) and the Drug and Poison Information Center at the University of Cincinnati. ACE, a joint venture between the Division of Adolescent Medicine, Children's Hospital Medical Center and Medical Center Information and Communications, University of Cincinnati, develops, produces, evaluates, and nationally distributes information and instructional material on adolescent health issues.

Adolescents and Alcohol is composed of dramas, discussions, and information on alcohol and is presented in a manner that teaches adolescents decision-making skills, such

as "saying no" to alcohol. Throughout the program, the user watches dramas that depict common happenings experienced by many adolescents. Within each of these dramas is a main character who is offered a drink. The main character asks the user "What should I do?" and the user must make a decision for the character by choosing from a list of suggestions that appear on the screen. The main character then vocalizes the decision that the learner chooses for him and the consequences of that decision are shown.

TARGET

A sophisticated interactive video program designed to assist high school students in developing decision-making skills regarding drug and alcohol use has been developed by an organization called TARGET. TARGET is a service organization of the National Federation of State High School Associations and is dedicated to helping students cope with alcohol and other drugs.

The program is known as the TARGET Interactive Project (TIP) and has been under development since early 1987. TIP uses an IBM INfoWindow to recreate real-life scenarios through computer-controlled branching and situational learning. The program dramatizes a high school party situation in which the user can select one of seven different characters to be for the evening. As the party progresses, each character encounters situations that call for decisions, which the viewer makes for the character. Some choices have immediate consequences, while others may not become obvious until the next day. The result is an experience that closely mirrors a movie or television program, with the viewer controlling what happens next.

TIP uses two videodisc players so that reaction to viewer choices is immediate. For example, if a drink is offered, the program responds with the character either taking or refusing the drink as soon as the viewer makes the choice by touching the screen. An integrated sync generator keeps the presentation seamless. In addition, the computer programming allows for some sophisticated program design. For example, most characters make not one but several choices throughout the evening; what happens to each is a result of all these choices. In addition, random elements can be introduced with statistical precision. This means that viewers may encounter different experiences even with identical decisions. This not only makes the program more realistic, it also enhances student interest.

Recognizing that the teenage viewing audience is visually sophisticated from watching commercial television programs, the developers of TIP used a first-rate cast of teenage performers, network production values, and entertaining scripting. The design and production was performed by Magnus Communications Design of Vancouver, BC, Canada. Other contributors include Hazelden-Cork Foundation of Minneapolis, Minnesota and IBM's Advanced Education Systems in Atlanta, Georgia.

The TIP system is available to high schools to use during the academic year. Future offerings of different topics are in the advanced planning stages.

Bellevue Hospital "Health Notes"

Visitors to Bellevue Hospital's Geriatric Clinic can call up health information at the touch of a finger through a new interactive video system that offers a menu of music videos in a jukebox format. Located in the waiting-room area of the clinic, the installation

provides health and wellness tips for the elderly in the form of video montages set to music.

Entitled *Health Notes*, patients can choose up to 10 musical selections, ranging from Mozart to Duke Ellington. They can also view a brief orientation to the clinic, narrated in English or Spanish. The system was designed by Manhattan Media Enterprises of New York City as a means of enhancing patient education without placing increased demands on hospital staff. The project was initiated and funded by the Bellevue Association, a non-profit volunteer organization that supports the work of the hospital.



Chapter 12

Marketing/Promotion

The first, and still the most successful use of videodisc has been to market or promote products and services. Pharmaceutical companies first picked up on the technology because of its ability to attract and hold the attention of physicians at conventions and tradeshows. Now, many healthcare providers are looking at videodisc and related technology as delivery systems for the promotion of their products and services.

Videodisc as a Marketing Tool

Interactive videodisc programs have scored a number of extraordinary successes in medical and healthcare marketing. At some national medical meetings, physicians have actually waited in line for a chance to use interactive medical education programs. On the average, the physicians then use the programs for more than 20 minutes, with many physicians staying at the exhibits for more than an hour.

The most recent evidence has shown that interactive programs attract more viewers and hold their attention longer than their linear counterparts. The programs achieve this success by merging the strengths of video communication with the capabilities of personal computers. Video itself is a potent communications tool. At its best, video utilizes the force of emotional appeal: the ability to touch a nerve, to move people, to tell a story in visual terms, to demonstrate a product, to sell to the psychological needs of viewers.

On the other hand, the computer is a superb repository of data and can provide instant access to each piece of stored information. It can process and alter that information, it can provide feedback to the user, and it can drill and repeat (as with computer-assisted education). In short, the computer offers a depth of substantive information that is virtually impossible in film and video. Interactive video--the combination of computer and video--therefore offers significant advantages over conventional communications:

Attracts More Attention. The use of novel touchscreen technology captures the attention of even the most sophisticated adults. Controlling a video program by touching the television screen is an enticing and intriguing notion to almost everyone.

Increases Viewer Involvement. Studies in educational psychology indicate that active participation in learning significantly increases comprehension and retention. Well-designed interactivity also enhances viewer enjoyment, a clear benefit to the learning process.

Holds Attention Longer. Thoughtful use of interactivity heightens and maintains interest over longer periods of time. The result is that interactive programs can be more persuasive than traditional media.

Increases Information Capacity. With the combined storage capacity of a 30-minute videotape and a 320K-byte floppy disc, interactive videodiscs provide greater depth of information than conventional audiovisual media. (The still-frame storage capacity of one videodisc side is equivalent to 54,000 slides. That's more than 600 carousel trays.)

Provides Improved Teaching Techniques. With their ability to branch, interactive videodisc programs effectively enhance learning by providing a technological simulation of patient case management, the traditional and still most powerful method of teaching and learning in medicine.

Offers Individualized Information Delivery. Because interactive videodisc programs are a series of discrete modules and because a videodisc program holds a wealth of information, it is possible to select portions of each program to create a lecture or sales presentation that meets the learning needs of a specific individual or small group of individuals. As a result, interactive videodisc programs can deliver medical marketing and educational information with unmatched persuasiveness by involving the physician in the presentation, providing an exceptional depth of information, and organizing the information to meet the specific needs of the particular viewer.

Applications for Interactive Videodiscs

The uses for interactive videodiscs span the spectrum of medical education and marketing. In marketing, they can be used as conventions and meeting exhibits, in group selling situations (e.g., dinner meetings of physicians), individual selling situations (e.g., detailed presentations), and at point-of-purchase (e.g., pharmacy for OTC products). As education tools, videodiscs are equally effective in group learning situations (such as grand round presentations, seminars, medical school classes, and sales training), or in individualized learning environments (such as in learning carrels in schools, hospitals and group practices and in learning kiosks for sales training).

Interactive videodisc technology delivers selling points effectively and persuasively; it is efficient at reaching diverse audience; it is memorable. It offers an extraordinarily powerful tool to attract attention, to inform, to demonstrate, and to sell. Its use marks the sponsor as a company in the forefront of communications technology and as a leader in its field.

Pharmaceutical Marketing

Interactive videodisc programs in medicine got their start, and have proven especially successful, as medical exhibits. Pharmaceutical companies employing videodisc programs in convention exhibits are obtaining three significant payoffs: 1) increased booth traffic, 2) increased access to prospects, and 3) more comprehensive delivery of marketing information.

Between trade shows, the interactive videodisc systems can be made available to the sponsor's field force for use in hospitals. Sales representatives can arrange to set up the systems in the physician's lounge or other appropriate place for a period of two to five

days so that all physicians in that medical center can use the program. However, careful consideration must be given to the design of such programs.

Interactive Design for Medical Marketing

Videodisc program design has many nuances, but the most successful designs have three characteristics in common: 1) they are medically substantive, 2) they are clinically useful, and 3) they are interactively challenging. The "wow" factor of videodisc technology can initially attract a physician's attention, but few programs can succeed without substantive educational value.

In all marketing, the buyer must be educated. For many consumer products, the learning process is simple and the selling process short. Often the product appeal is emotional. In these marketing circumstances, traditional one-dimensional advertising vehicles--newspapers, magazines, radio, TV--are adequate to inform and motivate purchasers.

Pharmaceutical and medical products, however, require a more involved learning process. Physicians require comprehensive information before adopting a new prescription product. Simple, one-way communication is usually inadequate to meet the information needs. Dialogue is crucial. As a result, detail calls are the core of most pharmaceutical marketing programs and receive the major budget allotment. The skilled sales representatives can sculpt the sales messages to the specific learning needs and expressed objections of the individual physician.

Well designed interactive video programs offer many of the advantages of the personal selling dialogue. Videodiscs can attain the depth of information of the best-trained sales representative and the physician can "question" the program about particular concerns. In addition, the well-planned interactive program offers unmatched visual impact. The result is the delivery of substantive and useful information in an intellectually-challenging and emotionally-satisfying learning process. For this reason, interactive videodisc programs have been extremely successful marketing tools for pharmaceutical companies. For more information on pharmaceutical videodiscs, see Chapter 2, *Pharmaceutical Companies*.

Medical Equipment Marketing

For the same reason that interactive videodisc programs are successful marketing tools for pharmaceutical companies, they are also being used increasingly by medical equipment companies as convention and tradeshow exhibits. Considering the number of medical equipment companies and their total volume of sales, it is reasonable to expect that the involvement of these companies may represent a substantial market to the suppliers of videodisc programs. Though the extent of participation of these companies has yet to be documented, there probably are scores of medical equipment companies using or planning to use videodisc technology for marketing and sales.

Hospital/HMO Marketing

Marketing healthcare services is a relatively new concept to the hospital community. Until recently, the major considerations of hospital management were issues dealing

primarily with cost containment, quality of medical and staff services, productivity enhancement, and general issues which were primarily driven from financial perspectives.

Hospital Chief Executive Officers were, and for the most part still are, highly bent on financial business management and are not trained in the overall strategic management of a marketing or product oriented business. Long-term business and strategic planning were not perceived as terms which applied to the hospital environment.

Outside forces are now driving the hospitals to face the realities of filling empty beds (profitably) or eventually face the disasters of any business whose revenue base evaporates. These include 1) Increasing financial pressures on the hospitals due to the regulation of their payment schedules set by federal and state agencies by Diagnostic Related Groups (DRGs), 2) Increasing pressures being applied for reduced charges by insurance companies and preferred provider organizations (PPOs), 3) Direct competition from health management organizations (HMOs) which provide a captive base of subscribers for their own facilities, and 4) Accelerating competition of the free-standing ambulatory care centers (ACC's) which are offering many hospital equivalent services on an outpatient basis.

Although the use of interactive video in hospital marketing programs is not necessarily a singular key to success, research indicated that the proper integration of the technology can add a significant component to these programs.

Community Relations Programs

Video is a powerful communications tool for maintaining hospital "good will" with the community as well as supporting the introduction of new hospital programs and services. In cases where community relations programs are carried out at the hospital site, interactive videodisc programs can be most effective. Videodisc programs can involve the individual in such a way that he or she can be made to feel that what they are learning is "customized" for them. A freestanding videodisc kiosk in the hospital lobby or waiting area can provide any type of information related to hospital services to the community. This will be perceived as being done for them by the hospital in the interest of their well-being, and is one of the most powerful marketing tools available. For example, programs could provide the following:

- An overview of the hospital and the quality of its services and staff,
- Self-directed information to an expectant mother about breast feeding for her soon-to-be-born infant,
- Information on a drug rehabilitation treatment program regarding the type of treatment and results that may be expected--all with complete anonymity of the user, or
- Details of a CPR course given for the community by the hospital.

Such hospital marketing programs can be extended to videodisc kiosks in public places such as shopping malls, local pharmacies, and other public places where the community can learn about wellness from the people who are there to care for them when the need arises.

Interactive Hospital Directories

Interactive videodisc programs can also be used effectively to orient visitors and patients to the layout and services of the hospital. Hospitals are now considering using videodisc kiosks as a "you are here" guide that would direct visitors to different departments and services. The kiosk can also provide users with information describing the most common tests and procedures.

Aside from their value as a community relations tool, management's interest in (and possible justification for) these information kiosks may include reduced costs associated with the "distraction" factor of the hospital staff whose work is interrupted when providing this information to patients and visitors. At least two commercial companies have developed interactive hospital directories, and at least one hospital has developed their own:

Physician International. In October, 1986, the first commercial information kiosk was offered specifically for medical environments. Physician International of Buffalo, New York, has developed an information kiosk for the health care industry called the Medi-Mark System. The system is billed as a high-impact, cost-effective, targeted marketing system for health care providers, and consists of a Sony computer, videodisc player, and 19-inch monitor housed in a movable kiosk.

The Medi-Mark System was designed to be used in hospital lobbies, physician waiting rooms, university health centers and other areas where medical marketing might prove beneficial. Consumers use the system's touch screen to select and receive information on health care services. Some of the recommended uses include: 1) Demonstrate departmental services, 2) Health education, 3) List physicians and credentials, 4) Building directory and map, 5) Describe outpatient services, 6) Explain insurance Coverage, 7) Explain policies, and 8) Promote complimentary services.

The Medi-Mark System had a number of add-on options available, including a brochure rack, bulletin board, printer, wheelchair access, and maintenance contracts. A single unit, complete with custom videodisc production, programming, and installation, cost around \$25,000 in 1986.

Lexitech Wayfinder. In 1989, Lexitech *Wayfinder* systems were installed in a half-dozen hospitals and medical centers. One of these was in the lobby of the new \$14 million Surgical Services Building at the Fontana medical center in California—owned by Kaiser Permanente. The *Wayfinder* is an interactive kiosk that helps the 130,000 Kaiser Permanente Health Plan members who use the facility each month to find their way around the 40-acre facility.

By touching the screen, Health plan members and other visitors can get printed directions to over 80 department and patient rooms in the 459 bed hospital. Theo Burins, Financial Manager at Fontana, expects the *Wayfinder* to not only increase staff productivity but also to improve overall services to Health Plan members. He feels that a member with printed directions is less likely to stop one of the staff people in the hallway for directions and more likely to get to their appointment on time.

Based on surveys conducted at several medical centers, Alex Richardson, President of Lexitech, estimates that lost employees, medical staff, and visitors cost a medical center from \$50,000 to \$75,000 each year in unproductive time.

University of Michigan Medical Center. Also called the *Wayfinder*, but unrelated to the commercial venture, is an interactive videodisc kiosk funded by the Hospital Information Services of the University of Michigan Medical Center. The purpose of the *Wayfinder* is to provide 24-hour-a-day assistance for visitors and patients to find locations in the medical center—which includes four major hospitals, a hotel, numerous outpatient clinics, and clinical services, as well as shops and eating facilities

Medical Center Directions. The first *Wayfinder* function is to provide an audiovisual preview of the desired route. The destination is selected by the user via menus on a touch screen. Once selected, a video segment of the route to this location is played from the videodisc. This segment takes the viewer down the halls of the medical center while a narrator points out landmarks and turning points. When the preview is finished, the user may elect to repeat the segment or receive a hardcopy printout of the route directions. The hardcopy printout is produced by a laser printer driven by the *Wayfinder* computer and is ejected through a slot in the kiosk.

Patient Locator. The *Wayfinder* also is able to help visitors locate patients within the medical center. The user enters the first and last name of the patient and the computer displays the floor and area designation of the patient's room. The *Wayfinder* then asks visitors if they would like directions to that floor. If so, *Wayfinder* directs visitors to the nursing center within the floor and area in order to protect patient privacy and promote orderly visitation.

Development and Evaluation. The *Wayfinder* was designed and produced between January and August of 1988. A limited program evaluation was conducted shortly after the *Wayfinder* kiosk was installed. The survey was completed by 94 users during a typical 24-hour period. Among those surveyed, 92 percent found the *Wayfinder* a significant help in finding their destination. Seventy-nine percent of the users requested a printed copy of instructions. All of the users who found *Wayfinder* of assistance said they would use it the next time they needed to find a destination at the medical center. Based on written evaluation, some changes are being made in the videotaped segments of future *Wayfinder* kiosks. Long hallway shots are being shortened to reduce the time span between important turning points and landmarks. Three additional *Wayfinder* kiosks are planned for the medical center, two of which are in production.

The *Wayfinder* hardware consists of an IBM InfoWindow system, Pioneer LD-V6000 videodisc player, and Hewlett Packard laser printer. Software development was done using IBM's IWPS authoring system. The videodisc contains 72 video segments using 30 minutes of video.

Chapter 13

CD-ROM

An area where optical discs are quickly being adopted is medical databases. These databases, which are stored on large computer or microfilm, now can be put on CD-ROM, mailed to subscribers, and easily updated on a regular basis. Once on CD-ROM, these databases are accessible through microcomputers, permitting hospitals and health sciences libraries to make unlimited interactive searches without on-line per-hour connect or telephone charges.

The MEDLINE database, compiled and maintained by the National Library of Medicine (NLM), is the most popular database for CD-ROM publishers. MEDLINE is recognized as the premier source of biomedical literature, covering virtually every subject in the broad field of biomedicine and corresponds to material in three printed indexes: Index Medicus, Index to Dental Literature, and International Nursing Index. According to NLM, at least 14 companies have obtained the rights to reproduce the database on optical products.

Other health-related databases which have made it to CD-ROM include those in life sciences, occupational safety and health, hazardous materials, cancer information, toxicology, drug evaluations, and popular reference books such as the Physicians's Desk Reference and The International Dictionary of Medicine and Biology. The following is a description of health-related databases which were available on CD-ROM as of January 1990.

Aries Systems Corp.

CANCERLIT KNOWLEDGE FINDER

CANCERLIT is produced by the National Cancer Institute in conjunction with the National Library of Medicine and contains a comprehensive collection of citations and abstracts of published cancer literature. Database contents are selected from over 3,000 biomedical journals, from papers presented at meetings, and from books, reports, and doctoral theses. Updated quarterly.

CORE JOURNALS

This database contains between four and five years of citations and abstracts from approximately 250 journals. The broad clinical content of the CORE JOURNALS disc makes it useful for internal medicine specialists, pre-med training, and general clinical knowledge dissemination in practice, hospital, and educational settings. Updated quarterly.

MEDLINE KNOWLEDGE FINDER

MEDLINE Knowledge Finder uses a MEDLINE subset drawn from 225 major biomedical journals and covering up to a five-year period. The database contains full citations, many with abstracts, drawn from all journals in the NLM's Abridged Index Medicus, and in the Brandon/Hill journal lists recommended for Small Medical Libraries, Nursing, and the Allied Health Sciences. Initially, the database will be offered in two configurations: from January 1985 through the present, and from January 1983 through the present. Each database configuration is contained on a single CD-ROM disc. The database also includes the MeSH vocabulary thesaurus, used to identify correct medical terminology and to facilitate searching.

PATHLINE

This disc includes all materials from about 300 pathology-related journals published during the last four complete calendar years. It includes coverage of clinical, anatomic, forensic, and surgical pathology. Updated quarterly.

RADLINE

This database was developed in conjunction with the Department of Radiology at the University of California, San Francisco. Drawing on all materials from about 100 radiology journals, the database also includes citations based upon a list of some 200 MeSH terms. The resulting collection of more than 250,000 citations covers a broad range of radiology sub-specialties, including imaging, computed tomography, neuroradiology, mammography, magnetic resonance imaging, and ultrasound. Updated quarterly.

BRS Information Technologies

BRS/COLLEAGUE DISC: MEDLINE

CD-ROM access to MEDLINE database. Beginning with 1986, the annual COLLEAGUE discs contain all MEDLINE English language citations for a given year.

Compact Cambridge

CANCERLIT CD-ROM

Prepared by the National Cancer Institute, CANCERLIT is a comprehensive database of citation/abstracts from over 3,000 biomedical journals. It gives clinicians and researchers quick, computerized access to published cancer literature worldwide. Papers presented at meetings, reports and doctoral theses are also abstracted in CANCERLIT. Journal articles are captured in the database within two months of publication. Since January 1985, new records have been indexed with chemical names and CAS Registry/EC numbers. Updated quarterly.

DRUGS DATABASE CD-ROM

Produced by the American Society of Hospital Pharmacists, this database contains detailed information on virtually every single-drug entity available in the United States. Data

on concentration, usage, stability, pH, dosage administration, compatibility, chemistry, pharmacology, interactions, and toxicity are included, along with bibliographic citation and drug monographs.

LIFE SCIENCES COLLECTION

The CD-ROM version of Life Sciences contains abstracts of the international professional literature in the fields of biochemistry, ecology, entomology, ethology, genetics, immunology, microbiology, toxicology, and virology. Coverage extends from January 1983 to August 1985. The system permits interactive Boolean searching in the command mode and also provides menu-driven assistance for such operations as searching, displaying, and downloading information.

MEDLINE: CAMBRIDGE

Compact Cambridge/Medline provides CD-ROM access to the international literature of biomedicine. The system permits interactive Boolean searching in the command mode and also provides menu-driven assistance for such operations as searching, displaying, and downloading information.

PDQ (PHYSICIANS' DATA QUERY): CAMBRIDGE

Produced by the National Cancer Institute, PDQ provides easy access to state-of-the-art cancer treatments. It consists of three interlinked files: cancer treatment information, on-going treatment protocols, and a directory of physicians and organizations that provide cancer care. Updated quarterly.

CONSULT

CONSULT provides the same up-to-date medical information that is included in Scientific American Medicine with comprehensive chapters on diagnosis, treatment, drug dosage, lab values, and more. It contains more than 2,300 pages of text, tables, and numerous full-color and black and white illustrations. In addition to the full text of each issue of Scientific American Medicine, CONSULT contains the complete library of DISCOTEST Patient Management Problems. Available for Continuing Medical Education credits, this library includes 40 cases.

POLTOX

This database covers the entire spectrum of scientific, industrial, and social concerns about toxic substances and environmental health. It combines the contents of five databases available exclusively from Cambridge, plus the National Library of Medicine's TOXLINE subfile and the Food Science and Technology Abstracts database maintained by the International Food Information Services. Contains a total of 800,000 records, accumulated over ten years.

CD Resources Inc.

AIDS INFORMATION AND EDUCATION WORLDWIDE

This CD-ROM contains a combination of international and national data on the many aspects of AIDS in their original, full text, format. Sources include the World Health Organization, US Center for Disease Control, National Commisisions on AIDS, and others. Includes information on the social aspect of AIDS (legislation, policy, costs, education), biological aspects (epidemiology, blood testing, immunology, and etiology), and resources (training, proceedures, services, organizations, and bibliographies).

EBSCO Electronic Information

MEDLINE: EBSCO

This disc contains a subset of the MEDLINE file (National Library of Medicine) for the past two years plus current year. Contains the Abridged Index Medicus titles and all English language nursing and dentistry titles. Search software is menu-driven with back referencing and MeSH explosion capabilities. It is designed so that "exploded" views of hierarchial indexes suppress duplicate citations. Databases are indexed using Fulcrum's . Ful/Text build, search and retrieval software produce and are retrieved by author, title, subject, CAS Registry Number, ISSN, keyword, entry month and/or journal title. Queries may be sorted for use in future searching.

Elsevier Science Publishers

EXCERPTA MEDICA

Approximately 150,000 abstracts per year about biomedical and related information are on the Excerpta Medica Library Service compact disc. These English-language abstracts are taken from 500 primary journals published in many different countries and languages. Included with a subscription to the CD is SilverPlatter's search and retrieval software.

Fachhochschule Hamburg

Multimedia CD-ROM

This CD-ROM was produced by four partners under the auspices of the European Community's Programme in Education and Training in Technology (COMETT). The disc contains training programs in dental radiology, aircraft hydraulics, pathology of the heart using the Netter illustrations, and British sculpture for the Tate Gallery. The disc was produced with the cooperation of the University of Milan, the Danish Computing Centre UNIC in Copenhagen, the British Broadcasting Corporation, and the Fachhochschule Hamburg in cooperation with Lufthansa and HAUPT.

Information Access Company

HEALTH INDEX

This CD-ROM contains articles from 100 top consumer sources for physical fitness, nutrition, and general health. Full indexing to each article is provided plus reference to all significant health-related articles published in more than 3,000 periodicals.

Institute for Scientific Information

SCIENCE CITATION INDEX

This disc contains ISI's Science Citation Index database. Software offers the ability to retrieve related articles by using the links created by authors when their bibliographies have references in common. Contains citation information and full bibliographic descriptions of over 600,000 source items from 3,300 scientific and technological journals. Free trial copy available.

Knowledge Access

CONSUMER DRUG INFORMATION

This disc provides consumer information on dosage, storage, side-effects, and any special considerations relating to the use of 250 generic drug types. Uses database developed by the American Society of Hospital Pharmacists.

NATASHA: NATIONAL ARCHIVE ON SEXUALITY, HEALTH & ADOLESCENCE

This disc provides access to the Data Archive on Adolescent Pregnancy and Pregnancy Prevention with 109 data sets and 39,815 uniquely identified variables from 82 major studies relevant to the national problem of teenage pregnancy. Information on adolescent sexuality, health, marriage, education, and employment; more general information on family planning, infant health, and attitudes toward sexual issues; and information on social demographics are all included in this product at national, regional, and individual levels. The Archive is sponsored by the US Office of Population Affairs under contract with Sociometrics Corporation.

NURSESEARCH

This disc contains bibliographic data from the Cumulative Index to Nursing & Allied Health Literature (CINAHL). Contains articles published in up to 61 nursing journals. "Order-form" feature allows the user to order full text copy of articles. 1988 subscription version updated quarterly; 1985-1987 versions available as single copies.

Medical Economics Company

PDR DIRECT ACCESS

Contains contents of PDR, including 1,800 prescription drugs, 1,100 non-prescription drugs, and 600 ophthalmology products. In order to find a desired drug, the user may select from six pre-set indices which allow location by Brand, Therapeutic Category, Interactions, Adverse Reaction, Generic Ingredient, and Manufacturer.

Medical Publishing Group

COMPACT LIBRARY: AIDS

This CD-ROM contains information from three major sources: 1) the AIDS Knowledge Base, 2) bibliographic files with references relevant to AIDS from MEDLINE and the Bureau of Hygiene and Tropical Disease database, and 3) the full text of articles on AIDS from a group of major journals. The Medical Publishing Group is the publishing arm of the Massachusetts Medical Society.

Micromedex Inc.

AFTERCARE INSTRUCTIONS

AfterCare Instructions is a simple-to-use system that provides printed instructions written in easily understood language. This system allows a nurse or physician in an emergency department or clinic to give discharged patients a set of specific instructions. It offers a way to educate patients about their injury or illness, their selfcare, reasons for calling or returning, and a way to notify patients of their physician's instructions for follow-up care. A second system is under development of drug instructions.

DOSING AND THERAPEUTIC TOOLS

Dosing and Therapeutic Tools is a database that contain Nomograms, Drug Dosing, EKG Rhythm Strips, Diagnostic Pearls, Differential Diagnostic Lists, and Calculators. This database helps clinicians make calculations or decisions regarding specific patient problems.

DRUGDEX

The Drugdex System is an up-to-date unbiased and referenced drug information system. It includes both drug evaluation and drug consults on over 3,700 investigational and foreign FDA approved and OTC preparations. This system is indexed by U.S. and foreign brand/trade names, disease states, and drug information terms.

EMERGINDEX

The Emergindex System is a reference clinical information system designed to present pertinent medical data for the practice of acute care medicine. This system is divided into six major sections: Clinical Reviews, Differential Reviews, Clinical Abstracts, Arrhythm-

mia Managements, Pre-Hospital Care, and Emergency & Critical Care Techniques. The database is indexed by way of a 40,000 key word medical thesaurus.

IDENTIDEX

The Identidex System is a unique tablet and capsule identification system that uses manufacturer imprint codes as the primary identification resource. Secondly included are color and physical description. The Identidex System contains over 21,000 entries and identification information on U.S. and foreign ethical/prescription drugs, OTC preparations, generic drugs, look-alike/rip-off drugs, and slang/street terms.

MARTINDALE: THE EXTRA PHARMACOPEIA

The CD-ROM version of this well-respected textbook published by the British Pharmaceutical Society, Martindale: The Extra Pharmacopoeia, is an extensive resource of information on drug products available in the United Kingdom. It includes information regarding chemical forms, therapeutic uses, adverse effects, and world-wide trade names. This version of the database also offers the ability to search by old English terms or their modern English synonyms. Updated yearly and can be searched by international trade name, generic name, chemical name, and disease state.

POISINDEX

The Poisindex System is a detailed toxicology database designed to identify and provide ingredient information on over 300,000 commercial, industrial, pharmaceutical, and botanical management/treatment protocols in the event of a toxicology due to ingestion, absorption, or inhalation of any of the substances listed. Poisindex is indexed by brand/trade name, manufacturer's name, generic/chemical name, street/slang terminology, botanical and common name.

TOMES

The TOMES System is a rapidly-expanding industrial chemical database with in-depth coverage of clinical effects, range of toxicity, workplace standards, kinetics, and physiochemical parameters. Detailed, comprehensive, and referenced protocols for the medical evaluation and treatment of individuals exposed to chemical agents are provided. Protocols for initial response to incidents (fires, spills, leaks) from hazardous materials are also included.

National Safety Data Corporation

MATERIAL SAFETY DATA SYSTEM

This CD-ROM contains detailed information on over 35,000 products that have hazardous materials. The Material Safety Data System will provide information about each product in 96 different categories including National Stock Number, item name, chemical family, handling, transportation, and storage of corrosive and toxic materials, health hazards, and emergency phone numbers. The software allows the user to find any specific safety sheet or locate any field or combination of fields on the entire disc in seconds. The text can be extracted and inserted into other files and documents via any word processor, or

saved or printed or flagged for later use. Users can also add their own bookmarks and comments to the safety sheets on the CD-ROM.

Occupational Health Services

OHS MSDS ON DISC

Contains information from the Material Safety Data Sheet.

Oxford University Press

OXFORD TEXTBOOK OF MEDICINE: ELECTRONIC EDITION

This CD-ROM contains the complete text of the second edition of the Oxford Textbook of Medicine. Tables and figures are not included in this edition, but captions have been enhanced with full description as appropriate. Includes one compact disc holding the text and five computer indexes. Offers rapid access to those parts of the text which contain the information required, including: Epidemiology, Diagnosis, Clinical Details, Treatment, Side Effects, and Further Reading.

Silver Platter Information Services

Biological Abstracts on Compact Disc

Developed by BIOSIS, the world's largest abstracting and indexing service for the life sciences, Biological Abstracts on Compact Disc (BA on CD) is the basic research tool for those in the biological and biomedical fields. Entries include bibliographic citations and abstracts of current research reported in the biological and biomedical literature. BA on CD provides searchable information on authors' institutional affiliations and language information for all citations. Approximately 250,000 records are indexed per year. Updated quarterly, beginning with the 1989 calendar year.

CANCER-CD

This disc contains references abstracts, and commentaries of the world's literature in cancer related subjects from Elsevier Science Publishers, Yearbook Medical Publishers, and the complete CANCERLIT file from the National Cancer Institute in conjunction with the National Library of Medicine. SilverPlatter has merged duplicate citations into one record while preserving information that is specific to each Information Provider to create this unique cancer research tool. Database covers current year plus six previous years. Updated quarterly.

CHEM-BANK TOSCA

CHEM-BANK is a single source of information on hazardous chemicals on compact disc. It includes four major databanks: RTECS (Registry of Toxic Effects of Chemical Substances from the National Institute for Occupational Safety and Health), OHMTADS (Oil and Hazardous Materials-Technical Assistance Data System from U.S. Environmental Protection Agency), CHRIS (Chemical Hazard Response Information System from the

U.S. Department of Transportation), and TOSCA (Toxic Substances Control Act), which was added in the fall of 1989. Updated quarterly.

CLINMED-CD

ClinMED-CD is a subset of the entire MEDLINE database focusing on clinical medicine and including journals, primarily in English, from the Abridged Index Medicus, the Brandon-Hill List from the Bulletin of Medical Library Association, and the Library for Inter-
nists List recommended by the American College of Physicians. ClinMED-CD includes AIDSLINE, a new bibliographic file from the NLM which includes all AIDS-related citations from MEDLINE, and 10 titles from the Year Book Series. ClinMED-CD covers five years of data on a single CD-ROM and is updated bimonthly.

HEALTHPLAN-CD

HealthPLAN-CD is a bibliographic file covering the non-clinical aspects of healthcare delivery, including, but not limited to, all aspects of administration and planning of healthcare facilities, health insurance and financial management, licensure and accreditation, personnel management, staff, planning, quality assurance, health maintenance organizations (HMOs), and related topics. The file, which contains data dating from 1975, includes over 420,000 citations supplied by the National Library of Medicine, the American Hospital Association, and the National Health Planning Information Center. It also includes the entire Hospital Literature Index. Updated quarterly.

MEDLINE ON SILVERPLATTER

MEDLINE on SilverPlatter contains the entire MEDLINE database of the National Library of Medicine from 1966 to present. It contains bibliographic citations and abstracts for biomedical literature, includes all foreign languages and all data elements, and is fully indexed. MEDLINE on SilverPlatter is available in a series of four volumes. Volume 1 covers 1966 to 1977. Volume 2 covers 1978 to 1982. Volume 3 covers 1983 to 1987. Volume 4 covers 1988 to present. Volume 4 is updated monthly. Volumes 1-3 are updated yearly.

NURSING & ALLIED HEALTH (CINAHL)-CD

Nursing & Allied Health (CINAHL)-CD is the Cumulative Index to Nursing and Allied Health Literature. It provides access to virtually all English-language nursing journals, publications of the American Nurses' Association, the National League for Nursing, and primary journals in more than a dozen allied health disciplines. It also includes selected articles from approximately 3,200 biomedical journals indexed in Index Medicus; from approximately 20 journals in the field of health sciences librarianship; and from educational, behavioral sciences, management, and popular literature. Updated bimonthly.

OSH-ROM MHIDAS

This disc contains three complete databases from NIOSH (National Institute for Occupational Safety and Health, U.S. Department of Health), HSELINE (Health and Safety Executive, a U.K. Government agency), and CISDOC (International Occupational Safety and Health Information Center of the International Labour Organization). MHIDAS, the Major Hazard Incident Data Service, developed by the Major Hazards Assessment Unit of the

British Health and Safety Executive, provides key information on over 3,000 major accidents involving chemicals and is scheduled to be added to the OSH-ROM disc in the fall of 1989. Collectively these databases contain over 300,000 citations taken from over 500 journals and 100,000 monographs and technical reports. Updated quarterly.

PDQ (PHYSICIANS DATA QUERY) ON SILVERPLATTER

PDQ is a database published by the National Cancer Institute containing state-of-the-art treatment recommendations for 80 types of cancer, over 1,100 cancer treatment protocols, and directories listing 12,000 physicians and 1,500 organizations involved in cancer treatment. Updated quarterly.

POPLINE

POPLINE is a bibliographic database containing more than 150,000 citations on population, family planning and related healthcare, law, and policy issues. The database reaches as far back as 1827 and includes citations and abstracts to journal articles, monographs, technical reports, and unpublished works. POPLINE is available through the MEDLARS system of the National Library of Medicine. The CD-ROM version of POPLINE is funded by the United Nations Population Fund. Updated semiannually.

PSYCLIT

Developed by the American Psychological Association. PsycLIT covers more than 1,300 journals and monographic series from approximately 45 countries, in more than a dozen languages. The PsycLIT Database provides summaries of the international literature in psychology and related fields compiled from Psychological Abstracts. International coverage from 1974 to present. Updated quarterly.

SPORTS DISCUS

SPORTS Discus is an international sports database corresponding to the printed publication Sport Bibliography. The database covers areas such as exercise physiology, medicine, biomechanics, coaching, counseling, psychology, and sports medicine. The database dates from 1975 and is based on more than 2,000 international sources. Updated semiannually.

TOXLINE ON SILVERPLATTER

TOXLINE on SilverPlatter is a collection of toxicological information from the National Library of Medicine containing references to published material and research in progress in the areas of adverse drug reactions, air pollution, carcinogenesis via chemicals, drug toxicity, food contamination, occupational hazards, pesticides and herbicides, toxicological analysis, water treatment, and more. TOXLINE on SilverPlatter includes the public domain records in the NLM file from 1981 to present. In the future, SilverPlatter hopes to add private domain and archival files. Updated quarterly.

Wiley Electronic Publishing

THE INTERNATIONAL DICTIONARY OF MEDICINE & BIOLOGY

This disc contains the entirety of the International Directory of Medicine and Biology. The 160,000 separate entries occupy more than 32,000 pages in the printed edition. The information is accessed through FINDIT, the search software. FINDIT uses proprietary indexing and retrieval techniques to deliver any record from the database in two seconds or less.



Chapter 14

Information Systems

Optical information systems store information—visual, textual, computer programs, etc. In almost all cases, a computer is required to catalog and retrieve the information. Optical information systems are just beginning to have an impact on the massive information storage and retrieval industry within the healthcare field. Though the technology is relatively new, it is already evident that optical disc will soon become the dominant storage medium for patient records, medical data bases, and medical images such as slides, X-rays, CAT, and MRI.

Image Storage & Retrieval

As medicine increasingly becomes a visual field, there is a growing need to store and retrieve these images for future reference. With advances in diagnostic imaging technology, physicians are now able to capture views of the human body never before available. Some of these images are in analog form, such as slides, photographs, and X-rays; others are produced in digital form, such as CAT scan and MRI images.

Slide Storage

Analog images, such as slides, are best stored on videodisc, with one side of a videodisc being able to hold up to 54,000 images. The slides are transferred to film then videotape, or directly to videotape, then pressed as a videodisc. When cataloged into a computer, any of these images can be retrieved in only a second or two.

Many of these "slide collections" are being used not only for reference, but as teaching tools. At the University of Washington alone, the Health Sciences Center for Educational Resources has produced at least four such discs on topics including hematology, leukemia morphology, and clinical microscopy. An accompanying catalog allows the generation of a wide variety of instructional programs using either the syllabi or computer control.

Because one videodisc can hold so many images, many health science schools are joining together to produce "shared discs." By each contributing slides to a single videodisc pressing, the cost of premastering and mastering can be divided among many schools, and therefore reduced significantly. Stewart Publishing Inc. occasionally sponsors a shared disc project, as well as announces shared disc projects organized by other groups. The final cost for participating in such a program usually runs from 90 cents to \$1.50 per image.

Direct-Read-After-Write (DRAW)

It is also possible for hospitals and other medical centers to record medical images directly onto videodisc without having to go through a mastering process. Panasonic markets a recordable videodisc unit, called the Optical Memory Disc Recorder (OMDR), which can be placed anywhere in the hospital, such as the Radiology Department.

Using the OMDR, hospitals can record X-rays and other medical images directly onto an 8-inch videodisc. Because it is a write-once technology, information recorded on the disc cannot be erased again.

One company in Florida, Image Resources, Inc. offers a medical images storage and retrieval system called MEDSAR (Medical Storage And Retrieval) based on the Panasonic OMDR. MEDSAR can record more than 10,000 images on a single disc, and can access these images in less than one-half of a second. MEDSAR comes with a built-in character generator which allows additional information to be recorded with the image, and a light pen which allows drawing and notations to be added to the screen. MEDSAR can also produce a hard copy print from any of the stored images.

Medical Record Keeping

Patient Information Systems, defined as complete patient data bases, are "still in their infancy" according to Peter Waegemann of the Institute for Medical Record Economics. Although these optical storage systems are just emerging, Waegemann is convinced that new data capture methods and data storage with optical disks will revolutionize the health care field. "The present documentation process consists of dictating information, transcribing it onto paper, manually assembling the medical record, and then converting it to microfilm," says Waegemann. "This process is soon to be replaced by computer technologies which will save both time and money."

Optical disk systems can eliminate all misfiling, avoid errors in the various traditional recording processes, and provide automated access to millions of documents within seconds. The direct-read-after-write (DRAW) technology makes it possible to record data in the medical setting, and is particularly desirable due to its non-erasability. The ramifications this has regarding legal concerns puts optical disk technology ahead of all other existing media.

"This seems to be one of the main applications of optical disc storage for the reason that information cannot be erased," say Mr. Waegemann. "This certainly helps the hospital in many legal areas. In addition, hospitals which must keep a large amount of records for long-term storage may also have problems with permanency. Tapes disintegrate, ink fades, and microfilm won't last either, so videodisc may be a solution to these problems."

The Optical Disc Industry

At the end of 1986, there were approximately 56 vendors offering some form of optical storage and retrieval systems, with more than half of these still in the development stages. The number of actual installations is still very low compared to the huge potential market. Only a total of 3,650 optical filing systems were reported to have been sold worldwide at the beginning of 1986, with that number remaining under 6,000 by the end of that year. The majority of these systems have been sold in Japan, with fewer than 200 10-inch or larger disc systems being sold in the United States.

The optical disc industry can be divided into five groups, based on the capacity of the system and its price. They are: 1) CD-ROM systems, which sell for less than \$25,000, 2) single disc drive systems, at approximately \$50,000, 3) jukebox, or autochanger systems, which sell for between \$100,000 and \$250,000, 4) custom-built automated systems, which cost in excess of \$200,000, and 5) system houses, which sell software only. Soon two more groups will be added to this list: CD-I systems (compact disc interactive) and Erasable discs.

The big advantage to optical disc systems is their capacity for massive storage and quick retrieval. Some systems using multiple disk devices can record and retrieve information automatically from sixty-four disks. These systems have a storage capacity of up to twenty million documents, which represent approximately 2,000 linear filing feet (LFF). Translated into records filing units, the optical storage and retrieval (OSAR) system contains the information of 1,700 five-drawer filing cabinets, or 338 double-sided, three-foot-wide, open shelf units with seven shelves each.

It is difficult to forecast when such systems will become standard; estimates vary from ten years to thirty years. It is probably fair to say that around the year 2000 the majority of hospitals will use on-line systems for the recording and processing of medical information as well as for its storage. Most of the present hesitation in regard to optical disk systems stems from its newness. It is not yet a proven long-term storage medium, nor is there a 'standard' method of structuring data bases. In addition, as with any new technology, many people are waiting for substantial price reductions before they decide to invest.

In the healthcare industry, two forms of optical disc systems have already begun to make their way into the hospital environment. There are now more than a dozen medical data bases available on CD-ROM, and delivery systems are affordable to most healthcare institutions. In addition, many Radiology Departments have installed write-once optical disc systems to record medical images. Only very recently have optical systems been installed for medical record use, the first of these being at the Maine Medical Center in Portland. Columbia Presbyterian Hospital in New York City has also been working for many months preparing for an optical disc system for general medical record use.

Comparing Optical Disc with Other Media

The comparison of optical storage and retrieval systems with other existing information carriers has to be conducted on two levels: 1) storage and retrieval characteristics and 2) cost. The three existing information carriers with which to compare optical storage systems are paper, microfilm, and magnetic carriers such as tapes, diskettes, and disk packs.

Permanence. Optical discs seem to be more resistant to chemical influences than microfilm or magnetic media. However, little is known about the long-term life of optical discs. Manufacturers claim that they will last for at least ten years. If the life of optical discs is limited to ten years, then they cannot be considered serious contenders in the archival and long-term record storage field. The people working on the development of optical disc storage and retrieval systems are aware of this dilemma and hope to provide some solutions in the near future. At this time, there is no obvious reason why optical discs cannot be developed as safe long-term information carriers.

Accessibility. Accessibility has to do with the time necessary to find information. Obviously, hardcopy systems allow accessibility in relationship to volume, facilities, and records management techniques. Microfilm, if stored manually, is easier to access than paper records because it represents less bulk. The new technologies of computer-assisted retrieval (CAR) and computer output microfilm (COM) offer great improvements in accessibility of data.

Optical discs promise to provide the real breakthrough in this field. For example, imagine finding one document among twenty million. For microfilm users, searching through thousands of microfiches may take a few minutes. Magnetic carriers can speed the retrieval to one minute or less. Optical discs, however, can access a document contained on one disc in less than a second, and in jukebox-like construction, find one of twenty million documents within ten seconds. The quick method of accessing information is one of the great advantages of optical discs.

Cost. When comparing costs of storage and retrieval for various media, one must consider storage costs, retrieval costs, and re-recording costs. According to these factors, costs for storing one hardcopy document can range from as low as under one cent to as high as 12 cents or more per year. Magnetic media are estimated to cost between five cents and ten cents and microfilm between three cents and 14 cents. The high cost of tapes, disks, diskettes, and their vulnerability to magnetic, static, and other influences make microfilm, with new developments in automated systems, the real challenger to optical disc. When taking all cost factors into consideration, optical discs seem to come out ahead. In general, a medical record professionals can use this rule of thumb: If twenty million documents are stored on paper or microfilm, is the cost of recording, storing, and servicing them equal to less than one and four-tenths cents per image per life cycle? Except in cases of off-site storage, it will be difficult to meet these figures with conventional information carriers.

Disadvantages. One disadvantage of optical storage and retrieval systems is that only one request can be processed at a time. Even when it takes only one second to find the requested document, if discs are changed, it may take up to ten seconds to find and retrieve the information and then reposition the system. There is no question that in most medical facilities, this process could create a tremendous bottleneck. Traditional systems allow multiple access. Optical systems do not.

Another negative side of optical disc technology is that it is not "record based," that is, requests must be for individual documents or sequences of documents, rather than for a complete subject record. It could be that users will not like this feature and that optical disc systems will not receive the user acceptance that is required to achieve success.

The acceptance of optical discs will depend on the acceptance of the technology with its reliability as a storage technique as well as its cost effectiveness. In addition, the acceptance of optical storage and retrieval systems will depend heavily on how records managers will make such systems workable within an organization. The design of active, semi-active, and inactive systems must be considered because activity will be the crucial factor for success.

Hospital Record-keeping

The Maine Medical Center (MMC) in Portland was the first hospital in the United States to install an optical disc system for medical record keeping. The system is the Medical Archival and Retrieval Solution (MARS), and was developed by Advanced Healthcare Systems, Inc. of Bethesda, Maryland.

MARS can be used for a full range of record requirements such as medical and patient account records and records generated by the accounting department. Designed in a modular format, MARS gives each facility complete control over how the system is initially configured and developed. The system can start with three terminals and expand to as many as 250 terminals with 1,000 billion bytes (140-224 million pages) of on-line storage—all accessible in 15-20 seconds at the press of a button.

In addition to storing, retrieving, and printing documents, MARS also provides a master patient index and abstract system. Users can define their own fields and design reports with the MARS Reportwriter. MARS incorporates IBM PC/ATs, high speed digital scanners, laser printers, optical discs, and high resolution monitors, operating on a Novell network with unlimited storage capacity.

Jerry Edson, Associate Vice President for Systems and Engineering at MMC, expects the new system to eliminate lost documents and streamline the production of medical records for legal and medical review purposes. This is an increasingly important feature of optical storage systems because the number of requests for medical records is skyrocketing under the new reimbursement rules and rigorous scrutiny of healthcare costs. "By using MARS, we are able to avoid the less attractive options that we had considered: hiring more personnel, employing an outside copying service, or committing more resources to enhance paper or microfilm systems," says Edson.

Edson considers the MARS system to be a flexible system with unlimited growth capability. "After implementing the medical records feature of MARS," he says, "we anticipate using it for patient accounting records and X-ray film storage."

Library Document Storage and Retrieval

As part of a research and development program to investigate electronic imaging technologies, the Lister Hill National Center for Biomedical Communications, the research arm of the National Library of Medicine (NLM) has developed a prototype electronic document storage and retrieval (EDSR) system. The prototype is being used as a laboratory testbed to investigate the applicability of this technology to biomedical document preservation, archival storage, online user access to document images, and other library information processing. The project also serves as a means for researching techniques for document scanning and digitization, storage, compression, image enhancement, access, retrieval, transfer, and display.

The prototype system has been implemented for electronic scanning, digitization, storage, retrieval and display of images of biomedical documents. Paper documents can be scanned and digitized at a resolution of 200 pixels per inch by using either a high-speed loose-leaf scanner with an automatic document transport or a book scanner with a manual book holder. Each scanner employs a high resolution CCD linear array operating at a sampling rate close to 10 MHz. The analog output signal of the CCD array is digitized into 1 bit per pixel two-tone images by means of dynamic thresholding. The digi-

tized images are stored on magnetic disks to be processed and subsequently transferred onto optical discs for archival storage. A PDP-11/44 processor with RSX-11M operating system functions as a system controller to control the data transfer and online access of document images. Existing online bibliographic databases developed by the National Library of Medicine are used as directories for the retrieval of document images. These images are displayed at a resolution of 200 pixels per inch in both softcopy (raster-refreshed CRT) and hardcopy forms.

The EDSR System

The EDSR prototype system has two 256Mb magnetic disk drives and an optical disc subsystem consisting of two Optimem 1000 optical disc drives for the storage of digitized images of biomedical documents. Each optical disc drive has a capacity of 1000 Mb for a total capacity of approximately 4000 images. The magnetic disks, capable of storing about 500 images each, are used primarily as temporary image buffers during the document capture and image retrieval processes. They also serve as working storage for optical disc file management information. The optical disc subsystem is the prototype for future large-scale archival storage capability.

Other Optical Disc Systems

A number of different groups have been working on various configurations for optical disc storage and retrieval systems. Some are being developed as a personal reference station, while others are designed to handle all the information contained in the Library of Medicine. The following describe a few of these systems.

MITRE Imaging Network

The MITRE Corporation of McLean, Virginia has developed an information system for Federal agencies interested in integrating traditional ADP activities with advanced imaging systems. The initial focus of their work has been on medical systems applications. The Integrated Information and Imaging Network was developed to demonstrate the integration of information and imaging systems using local area network technology; to incorporate multiple modes of optical storage for diverse applications, and to deliver system functionality through a simple user workstation, TV, and telephone.

The system has been engineered using both cable and optical fiber networks, giving users the ability to easily access the following capabilities over a simple user-oriented workstation: 1) access to mainframe computing, 2) voice mail, 3) video teleconferencing, 4) access to national networks, 5) computer graphics, 6) optical disc storage and retrieval systems, 7) robotics, and 8) image processing.

Interaction with the system can be carried out using voice recognition, computer keyboard or touch tone keys to select the desired system functions from a simple menu. Optical storage is being used for archival application, digital storage of X-rays, and capturing TV images from teleconferencing applications.

The system hardware consists of a MITRE produced analog read-only videodisc and both analog and digital WORM discs. Demonstrations of the system are available to Federal agencies upon request.

University of Pittsburgh

The University of Pittsburgh has developed an intelligent medical archives retrieval system (MARS, not to be confused with the commercial product MARS). A Common LISP programming environment for controlling videodisc and CD-ROMs has been written by the group. This program has been combined with a frame-based representational scheme for attaching linguistic descriptors to images and blocks of text. Graphics constructs can also be attached to images. An expert system has been developed to map user requests for medical information into laserdisc retrieval strategies. The knowledge base for this system is a semantic network of medical terms organized into a thesaurus. The hardware environment is a Macro Vax II with CD-ROM player networked to an IVIS videodisc system.

SeaMED Medical Reference System

SeaMED of Bothell, Washington has developed the SeaMED Medical Reference System, a proprietary development and runtime environment used for the design and delivery of medical knowledge-based applications. The company's initial product line includes a laboratory pathology system and a medical technologist training and advisory system.

The SeaMED Medical Reference System is made up of several layered object oriented software subsystems: *Applications Packages*. These adapt the Medical Reference System to virtually unlimited environments and requirements--such as medical school teaching and hospital departments. *Domain Specific Knowledge Bases*. These contain the text, illustrations, and video image data bases specific to a given domain. *Medical Reference System Shell*. This level includes a user development kit for building and maintaining additional knowledge bases, the applicable inference engine, and the executive process control software. *SeaMED Software Utilities*. This contains an advanced user interface, the message passing schema between layers, and the driver primitives for peripherals such as the videodiscs.

PATHSEARCH-Pathology Application

The SeaMED PATHSEARCH system consists of the SeaMED Medical Reference System and specific knowledge bases for hematology and tumors. It also includes office administration application software. PATHSEARCH is used by practicing pathologists to maximize their interpretive and diagnostic capabilities. The knowledge bases include the text, illustrations, video images, literature references, tutorial information, and decision support required for a differential diagnosis.

Since medical information and knowledge are constantly and rapidly changing, PATHSEARCH is offered on a subscription basis. The PATHSEARCH subscription includes two knowledge bases, knowledge base updates twice a year, software and hardware maintenance, and a PC and videodisc player.

Climax Medical Reference System

Climax Computer of Irvine, California is developing a Laser Video System to be used for image/audio presentations, inventory storage, retrieval systems and records archiving. At the 1986 MEDINFO conference in Washington, Climax was showing the sys-

tem using a program written around the Hematology videodisc developed at the University of Washington. The system included a Climax multi-user microcomputer, a Sony LDP-1000A videodisc player, keyboard, and an optional light pen or touchscreen input.

Erasable Optical Discs

In 1989, Philips and Du Pont Optical (PDO) announced an expansion of its optical disc manufacturing plant at Kings Mountain, North Carolina to produce erasable discs. Production will begin in 1990 and is planned to meet the growing demand for erasable optical discs.

Erasable optical discs are just beginning to come to market as a viable data storage alternative. PDO has introduced a 5 1/4-inch erasable optical disc that has a capacity of one gigabyte (2,000 floppy disks), seek time of 30 milliseconds, and an average transfer rate of about 10 megabits per second. In addition, the user can physically remove the disc and use it at another work station—flexibility not possible with a traditional magnetic hard disk.

Three leading erasable technologies are being pursued by the industry: thermomagneto-optical, phase change, and dye polymer. The PDO erasable disc is based on thermomagneto-optical (TMO) technology. The glass disc has a magneto sensitive layer that is protected by a thin layer of plastic. The sensitive layer is heated with a laser beam and modified with a magnet to create a binary code. A computer is required for transforming the digital code to data, a drawing, or image.

Thermomagneto-optical Discs. Today's TMO products must go through three functions to complete the erase cycle: one to erase the information, one to write the new information onto the disc, and one to verify the information. This is a disadvantage relative to the regular magnetic recording. PDO reports that designing a direct overwrite function will be difficult, but not inherently impossible. Despite this disadvantage, PDO feels TMO technology has emerged as the leading technology in the erasable optical disc industry for several reasons. First, because the change in the polarity of the magnetic domains does not involve actual melting of the information layer, the life cycle of the disc is 10^8 , far greater than the 1,000 or less cycles of phase change or dye polymer technologies. Secondly, the TMO technology was developed sooner than the other two. Finally, this method has strong historical precedence because of the similarities with regular magnetic disks.

Phase Change Discs. This process uses a laser beam to change the structure of the sensitive layer from an amorphous stable state to a crystalline state, and back. Thus the surface reflectivity changes from low to high, or vice versa. It is the reflection from the crystalline surface which is read by the laser as positive or negative.

Direct overwrite is relatively easy with phase change technology because the crystalline state is merely modified back to the amorphous state. In addition, this technology works with plastic substrates as well as glass, so overall cost can be reduced. The primary disadvantage of phase change technology is its limited life span. Because the transformation involves melting of the layer and recrystallization, preferred crystal orientation starts to occur, thus changing reflective properties. Also, the underlying layer can be damaged by the high transformation temperature. The life of a disc is only about 1,000 cycles to date, which is judged as being much too short for commercial use. However, it is pos-

sible that the present phase change life cycle is long enough for some consumer applications.

Dye Polymer Discs. This process is a topology change based on the heat of the laser beam. When applied to the sensitive layer, the laser creates a small "bump" on the surface or, inversely, reduces it. In this case, the "bump" scatters the laser light, resulting in a lower returned light level than on the flat parts. As in phase change technology, the temperature change can influence the structure of the underlying layer or affect the sensitive layer properties. The life cycle is reduced to less than 1,000 phases, making dye polymer technology less appropriate for current non-consumer use.

Other Research. Another area of research currently concentrates on the actual substrate used with these erasable technologies. Options include glass and plastic. Glass is the current favorite and will most likely always be used in high performance products. Glass is inherently flat which makes it easier to design the servo systems. Plastic has a tendency to ripple, making design accuracy more difficult. In addition, glass lasts longer than plastic. What's more, glass meets all of the testing procedures required by the International Standards Organization. However, PDO is confident that a reliable plastic substrate will be developed for an erasable optical disc and that this product will help reduce costs. The race is on between PDO, other Western manufacturers, and those in Japan to develop a viable plastic substrate.

Optical Card

Although the optical card is not an optical disc, it is included here because it is based on the same technology and is bound to have an impact on medical information storage and retrieval. The optical card is the size of a credit card and has a metal strip on which a laser reads and writes information in the form of microscopic pits.

The optical card can store from one megabyte to 200 megabytes of information per card. This equals up to 62,000 typed pages of information. The card is write-once-read-many (WORM) technology and may be updated (but not erased) as long as there is space available on the metal strip. The cards cost between \$3 and \$5 each to produce, with read-write units costing less than \$1,500 each. Read-only units are significantly less, with a price near \$200 each.

Applications for optical cards in healthcare include use as medical IDs, insurance IDs, outpatient cards, and medical records systems. Several companies around the world are already planning health-related uses for the optical card. The two primary manufacturers of optical cards are Drexler Technology and Optical Recording Corporation, and the first scheduled application was by Blue Cross and Blue Shield of Maryland.

Blue Cross/Blue Shield of Maryland

Drexler Technology of Mountain View, California was the first company to obtain a large contract for delivery of optical cards in the early part of 1985. At the time, Blue Cross and Blue Shield (BCBS) of Maryland announced plans to introduce the "LifeCard," a new membership card designed to allow each policyholder to carry their complete medical history in their pocket.

The LifeCard is designed to store up to 800 pages of medical information, including images such as X-rays, ECGs, EEGs, CAT scans, and NMRs. In addition, the wallet-sized

card is to contain a digitized photograph and signature of the member for positive personal identification.

Initially, information encoded on the card will come from a detailed questionnaire filled out by members and their physicians. The LifeCard can then be updated instantly by any provider, becoming a re-usable file that actually grows as a member's medical history expands. Perhaps the most valuable use of the card will be in emergency situations, where medical personnel can quickly review a patient's medical history, including drug allergies, chronic conditions, blood type, and current treatment. The LifeCard will also be a welcome aid in the prevention of hazards related to polypharmacy, or the prescription of drugs by more than one physician.

Hospital admissions and discharges are expected to be simplified with the use of the LifeCard. On admission, it will provide positive identification and an abstracted medical history with current drug record. While on the ward, the card will allow for basic graphing of cumulative data such as blood pressure, laboratory data, temperature, etc. On discharge, data can be entered onto the LifeCard to create an up-to-date history for subsequent providers as well as generate standard claims data, coding, and classifying DRGs.

The hardware system needed to read and write on the LifeCard consists of an IBM PC or compatible computer and a Read/Write Unit. This unit is to be supplied by Canon, Inc. of Japan, who was scheduled to begin shipments during the summer of 1986. They had plans to deliver 60,000 units during the first five-year period, with the possibility of reaching 750,000 units if the system was implemented nationwide.

Implementation Problems

Unfortunately, BCBS had unspecified problems with the Drexler card and, in 1986, demanded a second source of the cards before going ahead with its plan to use them for the LifeCard application. Drexler has the capability to produce approximately 37 million cards a year, and while they had 26 licensees worldwide, none had committed to manufacturing the cards as a second source.

Shortly after making this demand, BCBS signed a marketing agreement with Optical Recording Corporation (ORC) of Toronto, Ontario, developer of a higher capacity optical card technology. The relationship between the two moves is uncertain, but as of today, BCBC still has not fully developed and distributed the LifeCard on an optical medium. BCBC is also evaluating LifeCard as an integrated circuit (IC) card.

Pesch & Company

Meanwhile, other healthcare firms have signed up with Drexler Technology as licensees for their LaserCard. One of these is Pesch & Company, a major health maintenance organization in the U.S. Pesch has joined forces with CSK Corporation, a major information processing service company in Japan, to develop and market a LaserCard-based medical management system. The agreement provided additional capital assets to one of Pesch's subsidiaries, Genus Technology Corporation in Houston, Texas, to develop the system.

Genus will use a system combining a LaserCard reader/writer developed by CSK with a personal computer, and will be developing application software drawing on the ex-

pertise available from Pesch. Pesch, a top-ranking hospital management firm, has 90 general hospitals and a number of clinics, including the Republic Health Corporation which it purchased. Initially, Pesch will be applying the LaserCard system to client information management in the preventive medicine and adult disease fields. In a subsequent step, it will introduce the system into its own hospitals. The company also envisions selling the system to outside hospitals as well.

British Telecom

Expectant mothers at a major London hospital are now getting prenatal care under a trial there of British Telecom's personal medical record cards on which data is optically printed by laser. This is the first trial in Europe of personal medical records based on optical memory cards. These credit-card-sized pieces of plastic can hold up to 800 pages of text or eight video pictures.

In this scientific, controlled, trial, half the total of about 200 pregnant women attending the maternity department are being given one of British Telecom's *RecallCards*, which they bring with them to the department on each visit during their pregnancies. The cards are small enough to be carried easily in a wallet or handbag.

The *RecallCards* contain all the relevant information regarding the prospective mother and child-to-be, and enable doctors and midwives at the hospital to track the pregnancy as it develops and thus ensure that they give the best possible care. Each time the expectant mother attends the prenatal clinic she hands the card to the midwife or doctor, who inserts it into a card reader attached to a British Telecom M5200 personal computer. Data is displayed on the computer screen showing pregnancy history, records of previous visits and test results. New information available since the previous visit, or changes, would be entered.

In the control group, the *RecallCard* will be compared with a paper record (booklets) which will be given to the other expectant mothers attending the department. As the trial progresses to its completion next September, researchers will be comparing the completeness and accuracy of records on both *Recallcards* and booklets. They will also survey the staff and patients to find out their opinions of the two methods.

Other Uses Predicted. The maternity records trial is the first of several applications being considered for *RecallCards*. Nick Kane, Director of Marketing and Sales for British Telecom's UK Communications Division, feels the cards would make an ideal Pan European personal medical record card. "It is small, cheap, and robust, enabling everyone to carry their medical record with them at all times, to be immediately available if needed away from home or in an emergency," say Kane. "Its 2 MBytes capacity is sufficient for a complete cradle-to-grave medical history as well as X-rays, ECGs and other test results."

Technical Note. The *RecallCard* is based on optical memory card technology licensed by British Telecom from the Drexler Technology Corporation of Mountain View, California. The card is identical in size to a conventional credit card but instead of a magnetic strip it contains a large optical storage area on which up to 2 Mbytes of data may be held. Data is written onto the card by a low-powered laser contained in the *RecallCard* drive, which interfaces to a personal computer.

The storage mechanism is Write Once, Read Many (WORM) which cannot be erased, making the card ideal for applications where a permanent record of every entry is re-

quired. A special directory structure allows records to be updated, but previous entries always remain on the card for reference if required.

The system supplied by British Telecom for the trial consists of 13 M5200 personal computers equipped with *RecallCard* drives and specially developed obstetric records software. The PCs are interlinked over the company's TNet-100 local area network which provides communication between PCs and the hospital's ICL mainframe for the automatic transmission of selected statistics required centrally by the NHS. The *RealCard* drives used for the trial are supplied by the Nippon Conlux Company.

PCs are located at the maternity clinic reception, in each consulting room, in the delivery ward and in the ultrasound department. An additional PC in the patient waiting area allows mothers to review their own maternity records.

The obstetric records software has been designed in collaboration with the Department of Obstetrics and Gynecology at the hospital, and produced in-house by British Telecom. It provides customized screens for each stage of the maternity care process, with easy-to-read screen layouts and data entry by multiple-choice option wherever possible, reducing the amount of typing required and increasing uniformity of terminology.

Simple computation such as expected delivery date and pregnancy risk factor are undertaken automatically and displayed alongside related data so that the consultant can concentrate on making the best care decisions. Ultrasound measurements are displayed on-screen in the form of graphs so that trends and abnormalities can be readily detected by the consultant.

Matsushita Electric Industrial Company

Another Drexler licensee developing applications for the healthcare industry is Matsushita Electric Industrial (MEI). MEI announced it will develop a new computerized medical system for hospitals using optical discs to store information on patient history, diagnosis, and treatment records. Remote terminals will read the patient's LaserCard, record pathological history and other data, and exchange this information with the central optical disc system which stores data from past diagnoses and treatments. Physicians will be able to retrieve patient records at these terminals.

British Telecommunications PLC

British Telecommunications PLC, the largest telecommunications network operating company in the United Kingdom, paid one million dollars in 1986 to become the 26th Drexler licensee. British Telecom, with revenues last year of \$12.6 billion, plans to offer LaserCard information systems for a number of different applications, including medical records. The firm is negotiating with a major London hospital that is considering the use of LaserCards for holding maternity records. British Telecom might manufacture LaserCard readers/writers if local demand should warrant it.

Optical Recording Corporation's Hi-Lite Card

In December 1986 Blue Cross/Blue Shield (BCBS) of Maryland signed a technology marketing agreement with Optical Recording Corporation (ORC) of Toronto, Canada. BCBS, also a licensee with Drexler Corporation and their LaserCard, agreed to become a non-exclusive worldwide distributor of the ORC card, also known as the Hi-Lite card.

The Hi-Lite card is capable of storing 50 to 200 megabytes of data per side, 100 times the capacity of the LaserCard developed by Drexler and more than 1000 times the capacity of microchip-embedded Smart Cards. Information can be transferred on or off the card as fast as one to two megabites per second, approximately ten times faster than devices used with the Drexler LaserCard. The Hi-Lite card is also less expensive to replicate, with costs as low as one dollar each in quantities of 100,000.

John Adamson, president of ORC, noted that several potential licensees have expressed concern that ORC's technology could infringe the exclusive patent rights apparently claimed by Drexler Technology Corporation for the optical card. However, Mr. Adamson stated that ORC's technology does not infringe the patent rights of any company and, further, feels there is evidence to support the claim that ORC holds fundamental proprietary rights across all forms of digital optical data storage. ORC reports more than 20 companies looking at possible applications using the Hi-Lite card.

Patient Card Standards Council

In September 1987, representatives from medical associations and the data card industry formed a nonprofit organization to work on standards for credit-card sized patient cards that contain part or all of a patient's medical history. Five new technologies make up patient cards: magnetic striped cards, computer chip cards, optical cards, microfilm image cards, and combination cards which combine two or more of these technologies.

While a few vendors now offer patient cards, most of the technologies are expected to be perfected soon when HMOs, hospitals, physicians, clinics, and other healthcare providers will be offered these card systems. According to Peter Waegemann, Executive Director of the new council, patient cards have at least four major advantages over other record-keeping systems: 1) immediate access to medical history, 2) reduced waiting time as personal, insurance, and other admitting information is instantly transferred from card, 3) improved patient identification process for healthcare institutions, and 4) immediate administrative assistance in insurance processing.

The main objectives of the Patient Cards Standards Council are:

- To promote patient data cards in healthcare,
- To create an environment that allows patient cards to provide the highest level of benefits to healthcare providers, patients, and other groups,
- To work for technical and data content compatibility,
- To monitor standards within the data card industry and their use in healthcare institutions, and
- to strive for worldwide compatibility.

The Patient Card Standards Council will be run from the offices of the Institute for Medical Record Economics, Inc. in Boston, Massachusetts.



Chapter 15

Videodisc Research/Surveys

Videodisc Effectiveness – CPR Learning System

The CPR Learning System marketed by Actronics, Inc. has been the focus of much research because it provides the identical information that is presented in a CPR classroom environment. This makes it easy to compare the videodisc training with classroom, or live instructor training. The following is a summary of a few of the available reports.

Effectiveness of Interactive Video to Teach CPR Theory and Skills (1984)

This study was initiated in response to a request by the American Heart Association to compare the effectiveness of an interactive video system of CPR instruction versus traditional instruction. Two comparison groups of 50 students each were used as control and experimental groups. Most of the population consisted of nursing students between 18 and 20 years old. Evaluation was to be performed by former CPR instructors who were to test students from either group without knowing their mode of instruction.

The results showed no significant difference between interactive video instruction and traditional instruction in both skills and knowledge, with the exception of one area: the interactive video system taught skills for obstructed airway in the adult significantly better. During this study, it took approximately six to eight hours for basic life support in both groups including certification. The study concluded that a technological means of instruction such as interactive video can be a valuable adjunct in helping to meet present demands for CPR courses. (*Ann L. Lyness, School of Nursing, University of Pittsburgh*)

An Examination of the Use of Interactive Videodisc Cardiopulmonary Resuscitation Instruction for the Lay Community (1985)

At the time this study was done there were no other studies reported investigating the use of the Actronics CPR Learning System with the lay public. Studies undertaken in the design phase of the system had included only health professionals. Therefore, the purpose of this study was to examine the efficacy of the CPR Learning System for community CPR instruction at both the Heartsaver and BCLS levels.

An experimental group was taught CPR through the interactive videodisc system while a control group was taught by the traditional classroom method. The population was 65 employees of a major oil company. All groups were tested immediately following instruction and then retested at three months and one year. To determine performance

skills, each subject was asked to provide an "examination" tape within the allotted training time (subjects were not allowed to return with a tape at a later date). Those subjects in the control group produced a traditional tape from the manikin on which they trained. Subjects in the experimental group recorded their "examination" tape on the system's computer.

Results and Summary. Overall, there were no significant differences between the control group (traditional CPR instruction) and the experimental group (CPR Learning System) along the dimensions of initial skills performance, initial cognitive knowledge score, three-month skills retention, three-month cognitive knowledge retention, one year skills retention, and one year cognitive knowledge retention. Although a study based on a population of 65 is limited in many ways, it can be postulated that the CPR learning system is at least as effective as traditional CPR instruction. A continuation study was to be conducted using a population of more than 400 people. Results from that study may provide more conclusive information. (*Margaret J.A. Edwards, R.N., M.A. and Kathryn J. Hannah, R.N., Ph.D., Faculty of Nursing, The University of Calgary*)

Effectiveness of an Interactive Video Approach for CPR Recertification of Registered Nurses (1986)

The purpose of this 1986 study was to validate a specific interactive video teaching method for CPR recertification of Registered Nurses. The few studies that have been conducted to validate the use of an interactive teaching method to teach CPR have been limited to lay subjects or nursing students learning CPR for the first time.

The quasi experimental design randomized 57 Registered Nurses into interactive video or traditional lecture/demonstration teaching groups by their clinical work area (acute care vs. non acute care units). American Heart Association content and testing materials were used. Knowledge test scores and skill test scores were analyzed using ANOVA and Pearson Product Moment Correlation statistical methods.

Summary of Results. There was no significant difference found in knowledge or skill test scores between participants of the two teaching methods or between participants from different work areas. In addition, there was no correlation found between the number of CPR experiences a subject witnessed or performed in the clinical setting with knowledge or skill performance scores. Nurses who experienced the interactive teaching method preferred the interactive video method two to one. Instructor time was reduced 87 percent and participant time was reduced 11 percent on the interactive systems to learn the same content equally well. (*Doctoral Dissertation by Mary Elizabeth Aukerman, R.N., Ph.D., University of Pittsburgh. Sponsored by the Shadyside Hospital, Division of Nursing, Pittsburgh, Pennsylvania*)

Evaluation and Attitude Survey of the Actronics CPR Learning System (1986)

As part of the requirements to fulfill a New Jersey Department of Higher Education Computers in Curricula grant on *Improved Teaching of Cardiopulmonary Resuscitation*, the County College of Morris (CCM) conducted an evaluation and attitude survey among students who completed the college's CPR instruction program on the Actronics Learning System.

The survey was developed using a "forced choice" response method where students were asked to strongly agree, agree, disagree, or strongly disagree to each of 31 statements evaluating their use of the CPR system. There was no neutral response permitted on the survey form. An additional ten questions asked for a "yes" or "no" answer. Student comments were solicited on the form as well. A total of 87 surveys were mailed, with 31 returned (35.6 percent).

General Summary and Conclusions. The general trend of student responses indicated very positive attitudes about computer-based instruction. With very few exceptions, students were receptive to this type of instruction, noting that the most valuable aspect of this instruction was the ability to learn at one's own pace (100%). More than half of the students felt that the Actronics system was like "real people" teaching CPR (64.6%), 90.3 percent liked practicing CPR without a human instructor watching, and 80.7 percent enjoyed working alone.

Another very positive result of this instructional program is indicated by the students' willingness to recommend the interactive CPR course to other students (96.8%), and their willingness to take another interactive-based course if one were available in an area of interest (90.3%).

Student receptivity to the interactive CPR instruction program was high, with 96.8 percent indicating that they enjoyed using the system. Although 19.1 percent said they were frustrated by the system at first, the percentage dropped to 9.7 percent frustration at the end of the course.

There was a significant time savings for the students, with the average time to achieve Basic Rescuer certification being 7.56 hours (compared with 12 to 15 hours in a regular CPR class). A look at overall student records and testing results reveals a high level of mastery of the subject matter with 97.7 percent of all students completing certification in CPR on the system. This compares favorably with a traditional CPR class passing rate of approximately 80 percent.

Other Videodisc Effectiveness Studies

Full-Scale Pilot Testing of Florida's Videodisc Training Project (1984)

Florida's Department of Health and Rehabilitative Services decided in 1979 to train certain of its newly hired workers (approximately 500 annually) with a microcomputer-driven interactive videodisc program. Pilot testing of the 160-hour training program proved an average reduction in training time (over traditional delivery) of 25 percent. Upon taking a final exam following completion of the course, more trainees receiving the videodisc training passed the test (66%) than did trainees in the conventional program (50%). In general, trainees indicated a preference for computer-based instruction over traditional classroom instruction. (Smith, Richard C., *Full-Scale Pilot Testing of Florida's Videodisc Training Project*, Office of Interactive Technology and Training, The University of West Florida, Pensacola, Florida 32514)

University of Texas-Houston (1985)

A comparison of noninteractive and interactive video instruction about smokeless tobacco was conducted at the University of Houston, the results of which will be published

soon. After viewing a linear or interactive version of a videotape, experimental and control groups completed a questionnaire to ascertain knowledge and attitudes about smokeless tobacco and lesson satisfaction. The interactive video group demonstrated the most accurate and comprehensive recall. Additionally, the interactive video group was more willing to promote cessation among users. Learner satisfaction with the interactive video equipment and lesson was high. For additional information, contact Dr. Phyllis Levenson, Department of HPER, College of Education, University of Houston, Houston, TX 77004, 713/749-4386 or 713/721-4134.

Instructional Effectiveness of an Intelligent Videodisc in Biology (1984)

WICAT Systems, Inc. produced a "proof-of-concept" instructional videodisc in college biology with support from the National Science Foundation. Student learning with videodisc instruction was compared to traditional lecture learning in introductory biology courses at three different colleges. Videodisc students consistently displayed greater learning and retention gains, reduced study times, and higher productivity ratios. These findings were in agreement with the extensive literature on individualized instruction, both with respect to learning gains and time savings. Increased student confidence is also commonly reported in autotutorial courses. The values of imagery and experiential learning (direct and vicarious) are also widely touted, although less documented by hard data. (Bunderson, C.V., Baillio, B., Olsen, J.B., Lipson, J.I., Fisher, K.M., *Interactive Effectiveness of an Intelligent Videodisc in Biology*, Machine-Mediated Learning, V.1, No. 2, 1984.

Chemistry Videodisc (1986)

The Chemistry Department of the University of Illinois, through a grant from IBM, has developed Project EXCEL, a system of interactive videodisc and PC work stations to teach basic chemistry to incoming students. They have 16 work stations available 14 hours a day. The stations were Beta-tested in the spring session by students who had not taken any chemistry courses in high school. Test results showed a higher understanding of the material by those students who used the disc systems as opposed to those who only had lab experience.

The Evaluation of Science Lab Videodiscs (1984)

Educators at the University of California in Berkeley compared use of videodiscs simulating science laboratory experiments with actual laboratory experience. The videodiscs used were produced by the University of Nebraska with a grant from the Annenberg/CPB Project. The subjects covered by the programs were physics, chemistry, and biology. The researchers found that students using videodisc typically work through an experiment more quickly than those in a conventional lab setting, due primarily to the "instant" results available with the videodisc program. The videodisc simulation also enabled students to examine a wider variety of conditions than is possible in a traditional lab.

Observations revealed that students using the videodisc appeared less confused about what to do than students in the traditional lab, who frequently checked with the Teaching Assistant to make sure the experiment was being conducted accurately. It was also found that the videodisc students exhibited more task-oriented behavior and self-suffi-

ciency. Videodisc students performed as well or better than their lab counterparts when given tests following the lab experience. (Paper presented at Fifth Annual Nebraska Videodisc Symposium, August 1984 by Barbara Gross Davis, University of California, Berkeley, CA 94720)

GM's Hazardous Materials Training

Hazard communication training at GM

In 1985, the UAW-GM National Joint Committee on Health and Safety appointed a task force to develop a hazardous materials training program for GM employees. The result of their efforts was the UAW-GM Hazard Communication Training Program. There are nine modules in the interactive video training program that address various types of hazardous materials handled by GM workers. A second version of the training using video tape was also produced. This version has the same nine modules as the interactive video. It also has a comprehensive trainer's guide for conducting an effective classroom training program.

The Evaluation. It was decided that, following completion of the development of the Hazard Communication Training Program, an in-house evaluation would be conducted as well. Two-hundred and nine workers from 15 GM plants in the Midwest participated in the evaluation. They came to the UAW-GM Human Resource Center in Madison Heights where the evaluation was conducted.

The module on solvents was used for the evaluation. Participants who had not had training on this module were used. Training was done using the interactive Laser Disc System and a "best case" classroom training involving an expert trainer who followed carefully developed procedures. The amount of learning of the content of the training and of attitudes were tested.

Results. The results of the evaluation showed positive results for the interactive laser disc training. When the Interactive Laser Disc Training was compared with a "best case" classroom training, the Interactive Laser Disc Training produced more learning. The average scores on the 16-point test were: laser disc group = 13 (81%); classroom group = 10 (63%). The ILDS group scored 26% better than the classroom group. The workers who did the best and worst on the test were compared. Most of the workers who did the best (high achievers) had been trained on the Interactive Laser Disc System. Most who did the poorest (low achievers) had been trained in the classroom instruction.

Attitude Toward Interactive Training. In the comparison of the two training methods, attitudes about the Interactive Laser Disc training were the most positive. Eighty percent of the workers preferred the Interactive Laser Disc training to the classroom. Seventy percent felt it was easier to pay attention to the Interactive Laser Disc training. Seventy-eight percent felt they learned more from Interactive Laser Disc training. Ninety-eight percent felt it was easy to use the Interactive Laser Disc System.

All workers performed equally well on the Interactive Laser Disc System. Age, sex, amount of education, and years of employment at GM did not limit their success in training. In addition, attitudes toward the System were not affected by any of these factors. The attitudes were highly positive in all groups.

The average time to complete the ILDS instruction was 33.87 minutes/student. The average time to complete the classroom instruction was 33.25 minutes/student. The difference in training time was minimal.

Conclusion. The evaluation showed that the Interactive Laser Disc System was very effective in achieving training objectives, strongly preferred by workers, and competitive with the classroom method in the amount of time taken to complete the training.

National Board of Medical Examiners—Computer-based Testing Program (1987)

The computer-based simulation test (CBX) developed by the National Board of Medical Examiners was evaluated in a large pilot test. Results of this pilot test were reviewed by an independent advisory panel which concluded the following, which is quoted from the Interim Report of the Computer-Based Testing Advisory Panel, September 15, 1987:

- CBX succeeded in measuring a quality not measured by multiple-choice questions (MCQ) or written patient management problems (PMP) that may reasonably be considered to be related to "general clinical competence." Scores tended to be consistent across varied cases; only a few cases were clearly easier for the residents in the "matching" clinical specialty.
- The procedures for developing cases and scoring keys have progressed to the point of being clinically and psychometrically acceptable. They are now practical for an operational test, though there is much room for improvement. . . Although general computer experience as such had no influence on scores, CBX showed a strong practice effect in the pilot study. This and other evidence implied the need for extended examinee familiarization prior to taking the test.
- Precision of measurement at the low end of the scale is a major concern. . . With present cases and scoring methods, CBX and PMP have about equal precision when the testing time is held constant. However, the error of measurement is large. Changes in length and difficulty of cases and in decision rules, including sequential and/or adaptive testing, have been suggested for trial. It is hoped that these will permit a one-day computer-based test for all but borderline candidates.
- The Computer-based Testing Advisory Panel has reviewed the status of the NBME CBT project following pilot studies on medical students and residents and is impressed by the progress that has been made. Now, for the first time, software and cases are ready for dissemination beyond settings controlled by NBME. On the other hand, we conclude that CBT should be used for certification and licensing only after the model and selected cases have been made available for student practice and experimentation in most LCME-accredited medical schools.
- In summary, we strongly recommend that NBME continue to support CBT . . . We believe the NBME should continue its current level of developmental activity on the CBT project directed at ultimate use in the NBME certification sequence.

Additional results are available in the chapter entitled Testing & Certification.

Field Testing at Medical Schools. The National Board of Medical Examiners also is testing their new Computer-Based Examination (CBX) at 70 medical schools nationwide.

The exam includes multiple choice questions identical to those currently administered in the Part I, II, and III paper-based exams. In addition, the CBX includes an open-ended videodisc-based simulation that is designed to provide an uncued test of patient management skills.

Each participating school or test site was required to purchase three delivery systems, each consisting of an IBM-PC XT or equivalent, and either a Pioneer LD-V6000 series, Sony LDP-1200, or LDP-1500 videodisc player. The videodisc simulation portion uses a two-screen presentation method which eliminates the need for video overlay and keeps the cost per system at about \$2,500.

While the entire CBX is still in a research phase to evaluate its effectiveness, the multiple choice part will be certified soon as a standard part of the exam process. The simulation will require additional research to determine the validity of scores for the open-ended procedure.

During 1988, 16,703 people took the part I exam, while parts II and III each were taken by more than 13,000. Stephen Clyman (CBX project director) sees the potential for multiple systems to be installed at each of the 144 medical schools in the US and Canada, with at least two sites per state.

Feedback from Test Sites. The NBME has collected and released summary evaluations provided by 23 of the CBX testing sites. The following is a review of these results.

The majority of students using the CBX cases were third year students (71.4%). They were scheduled to go through the cases either as tests or as preparation for class discussion. As each case was completed, printouts of actions, and the sequence of actions taken by each student, were made available to faculty.

The Medical College of Pennsylvania was the first to receive the CBX cases fifteen months ago, where they have been used extensively in the surgical department. Faculty at this institution reported that the greatest values of the CBX include assisting students to learn problem-solving, establishing priorities, and patient management. After running the CBX cases, students attended tutorial sessions where their cases were reviewed. The faculty and students discussed different approaches to each patient problem and the establishment of priorities. They also discussed how to ration time and how to distinguish between what constitutes an emergency and what is routine. Students reported that the CBX cases made it possible to achieve goals that were not otherwise attainable. Specifically, they cited the opportunity to actively play the role of a physician. Another advantage they noted was that anxiety was considerably reduced in working with the computer as compared to the anxiety experienced at the bedside.

A significant finding at George Washington University was reported. Fifty senior students ran ten cases each. In reviewing the simulation printouts, faculty found that six senior students took actions that were deemed highly inappropriate and raised questions about their problem-solving skills. What surprised the faculty was that, in all but one instance, these behaviors were not discovered from clinical evaluations of the students. According to Dr. Piemme, these simulations may be powerful tools to identify inappropriate behavior that cannot be evaluated clinically, such as "the ability to do parallel processing."

During their exit interviews, senior students commented that they learned more in a day of running the simulations than they could have learned in weeks in the clinical setting. As a consequence of the positive results achieved through use of the CBX simula-

tions, the department of medicine at George Washington began requiring other computer simulations. In addition, the obstetrics and gynecology department now administers their final examination by computer.

An unanticipated benefit was reported by the University of Michigan. "When many of the students neglected critical areas of patient diagnosis or management, there was much discussion among the faculty about methodologies for improving the teaching of those concepts."

At Johns Hopkins University, 56 students assigned the CBX cases scored significantly higher on the case management problems in their final examination than did the 138 preceding students (p.008). In addition, their self-assessment scores were higher for "identification of critical aspects of patient problems, recognition of life-threatening situations, recognition of psychosocial/patient education issues, and institution of timely interventions (p.001)."

In reviewing these 23 reports, several commonalties emerge: 1) student interest and enthusiasm for the simulations mirrored that of their faculty; 2) when student experiences were positive, awareness among faculty expanded and many implemented simulations from other sources; and 3) faculty believed that the CBX measures behaviors and skills that are not measured by other examinations.

Evaluation of Videodisc Use and Development at MSU.

The Pathology Department at Michigan State University has developed instructional units on Neuropathology using two types of videodisc systems: an IBM InfoWindow system and a two-screen Macintosh system. The purpose of this exercise was to determine undergraduate medical student response to this type of educational technology, to assess differences in development, and to obtain student evaluations of specific features of each system.

Using the *Slice of Life* videodisc distributed by the University of Utah, a unit on *Central Nervous System Neoplasms* was developed as a HyperCard stack for the Macintosh system, and a unit on *Cerebrovascular Disorders* was developed for the InfoWindow system using the LS-1 authoring system. Each unit consisted of five parts: a pretest, and instructional lesson, a post-test, a clinical simulation emphasizing reinforcement of concepts and problem-solving related to neuroanatomy, neuropathology and neurology, and a glossary.

The units were recommended to students for use on a supplemental basis and subjective evaluation was conducted. During the fall term of 1988, 68 of 119 students completed an evaluation form for at least one of the units and 52 of 119 completed forms for both units. The time spent by students on the lesson and case simulation sections was assessed.

The content and presentation for both were rated very good to excellent. Features that students emphasized as desirable included: 1) flexibility in controlling locations within sections (e.g. ability to go to the previous screen and randomly access any topic in the Macintosh unit), 2) easy access to glossary definitions, 3) diagrams and images, 4) availability of help screens, 5) high screen resolution, 6) integration of information from several disciplines, and 7) application of clinical and basic science information in a problem-solving case history format.

A one-screen system was not preferred in this setting. Difficulties experienced by students using each type of unit for the first time were assessed for future changes in Learning Resource Center procedures and program format. In comparison of development efficiency, the Macintosh HyperCard unit required less authoring time. In general, the availability of Neuropathology interactive videodisc instruction on both systems was enthusiastically received by the medical students and the features rated by students as most important were determined for consideration in development of additional units.

Videodisc Surveys

Kent State Survey

A survey on the use of interactive video has been completed by the Instructional Resource Center at Kent State University. The survey consisted of 13 questions ranging from "What type of Computer do you primarily use with interactive video?" to "What is the approximate average cost of the programs you produce?"

Approximately 360 surveys were returned, with 250 responding that they were "personally developing and/or using interactive video." The following is a summary of responses from this group:

- Education (57%) rated as the most common use of interactive video, followed by Training (29%), Research (7%), Sales (4%), and Archival (2%).
- The majority of respondents used IBM or compatible computers (54%), with 33 percent using Apple II series computers and one percent using Macintosh computers.
- Most respondents used videodisc for their programs (84%) versus 16 percent using videotape.
- The majority of interactive programs were Level III (84%) followed by Level I (8%), Level II (6%), and Level IV (2%).
- On average, respondents were using 33.1 interactive video units to play 9.4 interactive programs.
- Seventy-four percent felt that interactive video will be adopted at an increasing rate, while nine percent felt it will be replaced within two years by a better medium.
- When asked to check the most important needs for the improved adoption of interactive video, the top responses included Cheaper Hardware and Software (63%), Standardization of Equipment (53%), Increased Visibility of Good Examples of the Medium (47%), Better Authoring Systems (36%), and Cheaper Disc Production (28%).
- Seventy-six percent of those using interactive video were also involved in its production, having produced, on the average, 11.3 programs each.
- Thirty-five percent of the programs produced cost under \$10,000, with 25 percent costing over \$90,000. The remaining 40 percent was spread out evenly in-between.

A portion of these results were presented at the National Videodisc Symposium for Education in Nebraska last October and at the annual conference of the Association for Educational Communications and Technology in New Orleans in January 1988.

Survey Looks at Videodisc Repurposing

Recently, the U.S. Department of Education awarded VANTAGE POINT Systems a Small Business Innovation Research (SBIR) contract to examine aspects of the process known as "repurposing" a videodisc. In this research, several issues and terms require clarification. To delineate some of the issues, and attempt to standardize some terminology used to describe the repurposing process, VANTAGE POINT Systems plans to conduct a survey of videodisc professionals.

The study specifically aims to examine three aspects of repurposing, namely the 1) promise and potential of the concept, 2) design and development process for repurposing, and 3) legal implications of the approach. Some of the issues and questions to be addressed include the following:

- How does repurposing differ from a traditional instructional systems development process?
- How will the T3 (Training Technology Transfer) Bill affect repurposing?
- Can you copyright and sell instructional courseware developed around a videodisc produced by the Federal government? How can you package copies of the government produced videodisc with your courseware?
- If you create courseware to accompany an existing videodisc, how can you guarantee continual pressing of new copies of the disc to accompany your software?
- As a producer of a generic videodisc, how can you guarantee development of high quality repurposed courseware complimentary to your laserdisc?

Results of this survey were discussed at the Washington Videodisc Conference, October 18-21, 1987. Transcripts are available through Stewart Publishing, Inc.

Healthcare Survey

In 1986 the *MedicalDisc Reporter* conducted an informal survey of its subscribers to ascertain the number and type of videodisc hardware systems that were in place. Although the data from the survey is several years old, it does provide an interesting look at the distribution pattern at the time.

Surveys were sent to 500 subscribers with a total of 78 responding that they owned at least one videodisc system. Seventy percent of the respondents were from health sciences schools, while 21 percent were from hospital settings. The remaining nine percent were from miscellaneous settings.

- Regarding the systems themselves, 77 percent had Pioneer players, 21 percent Sony players, and two percent Hitachi players.
- IBM compatible computers were most prevalent (54%), with 28 percent of the systems using an Apple II computer, and seven percent using the Apple Macintosh.
- No single overlay board stood out, with 13 different companies being represented.
- Most of the videodisc systems were located in a learning resource center (40%) or a library (35%), followed by hospital education departments (11%), academic departments (10%), and audiovisual departments (3%).

- Eighty-four percent of the respondents indicated a high interest in purchasing videodisc courseware, while 60 percent were also highly interested in producing their own courseware.

Healthcare Use of Videodisc

The University of Tennessee and The George Washington University Medical Center have conducted a survey of videodisc usage in health science institutions throughout the United States. The survey's administrators feel that the potential of videodisc technology in health sciences education is exciting and timely, and that it is important for biocommunication professionals to know the direction which health science centers and hospitals are taking with regard to the technology.

The survey was developed by Tom Singarella and Howard Ramagli at the University of Tennessee with Shelley Bader at the George Washington University Medical Center. It was distributed to 1449 names taken from the Association of American Medical Colleges, including administrators in hospitals, GME, computers in medical education, health science library directors, computer science directors, and members of ABCD.

Approximately 169 of the surveys were returned (11%). The results of the survey indicate a wide range of videodisc usage in some health sciences institutions. Still being analyzed, they are providing demographic information about host institutions, the type of videodisc hardware and software being used, how it is being used, and purchase and development plans over the next year. Some early general conclusions of the survey are:

- Health science professionals seem to be waiting to see what is going to happen in the health sciences field with regard to videodisc technology
- there has been no firm commitment to any particular form of videodisc technology
- most respondents (79%) plan to purchase videodisc equipment in the next year
- many respondents (72%) plan to develop videodisc programs in the next year
- videodisc development is, for the most part (77%) not centralized within the health science centers, campuses, or institutions
- Pioneer videodisc players outnumbered Sony players 3 to 1.
- most respondents (80%) indicated that their interactive videodisc system was a non-dedicated system and that in most cases they wrote their own software

Most respondents indicated in their comments that they believe there is a future for interactive videodisc development in health science institutions and that use of the technology will increase. Survey results have been reported to the *Journal of Biocommunication* and will be published as part of a special issue (Volume 15, Issue 3, May 1988) on videodisc technology.

Videodiscs in Academic Health Sciences Libraries

One of the groups included in the survey conducted by the University of Tennessee and the George Washington University was directors of academic health sciences librar-

ies. This group was analyzed separately by Thomas Singarella, Ph.D., Shelley Bader, M.L.S., and Howard J. Ramagli, Ph.D. for inclusion in this edition of *Videodiscs in Healthcare*. The results of this survey should be useful to library administrators, librarians, and other professionals who need to examine what libraries have invested in this technology. Knowing what resources libraries are willing to commit to this technology will help in predicting future trends.

Survey Design. The survey, which used a simple descriptive design, was mailed to the 127 members of the Association of Academic Health Sciences Library Directors (AAHSLD). The first page of the survey provided definitions of the technology and requested demographic information. In December 1986, 51 (40%) completed surveys were returned. The data was analyzed using the ORACLE software package on a DEC VAX 8600 computer.

Questions and Findings. While a little less than half the respondents indicated that they already had some form of interactive videodisc technology, half of the remaining respondents indicated that they planned to have some form of the technology in the next year. Of those who already had videodisc technology, most planned to purchase additional players or software in the next year.

Interactive Videodisc Equipment. There were more Pioneer videodisc players (49%) than Sony or JVC (18%) each. IBM and compatibles represented the largest computer group (76%), with Apple IIs being next (20%). At the time, there was only one IBM Info-Window and three DEC IVIS systems (now discontinued). The IVIS systems probably represented Intelligent Images Dxtex workstations.

Cost Levels of Videodisc Programs. Respondents indicated the maximum cost level at which they would generally consider purchasing a videodisc program: Level I (\$229), Level II (\$300), Level III (\$422), and Level IV (\$567).

Development of Own Videodisc. With regard to what kinds of videodisc development respondents were doing within their institution, 12 (50%) respondents indicated no activity, three (12.5%) indicated plans to develop videodiscs, and nine (37.5%) were currently developing videodiscs.

Conclusions. With half of the library directors reporting they already have, or have plans for acquiring, videodisc technology, we may see heightened interest in this technology within health sciences libraries in the future. In addition, a number of libraries show an interest in "repurposing" generic Level I discs to Level III using appropriate computer software.

It appears that many libraries are waiting for the field to "settle down" before they purchase. Librarians are acutely aware that there are no industry standards and are wary of the waste that can be incurred by investing in hardware systems whose utility is defined by a limited range of software.

One interesting finding was the amount of money respondents indicated they were willing to spend on commercially available videodisc programs. The amount library directors indicated they were willing to spend for Level I programs (mean = \$229) accurately reflects the current price range for programs at that level. However, directors indicated a mean of only \$422 as what they were willing to pay for Level III programs—which actually sell for between \$800 and \$1700.

Closing Remarks. This survey provides an interesting first glimpse into videodisc technology in academic health sciences libraries. The authors intend to conduct another survey to chart the "movement" or infiltration of videodisc technology within the academic health sciences community, and to examine videodisc program utilization.

The U.S. Videodisc Market: Analysis and Forecasts to 1990

This 1985 study is a comprehensive review and forecast of the videodisc market produced by *The Videodisc Monitor*. The report, which sells for \$795, features a concise and thorough review of individual sub-markets (training, POP, games, education, military, entertainment, etc.) and includes complete forecasts of sales, installed base, and overall growth rate of these sub-markets through 1990. Several comparative charts, full contact information for all firms mentioned, and a brief history of the technology are also included. The following is a brief summary of the report.

The total videodisc market will continue to grow at a conservative but positive rate, with the installed base of industrial players increasing by an average of 32 percent annually over the six-year period beginning in 1985, through a base of over 400,000 players by the end of 1990.

In order from the largest to smallest, cumulative dollar non-consumer markets (combining hardware and software revenues) will be training, point-of-purchase, military, medical, and publishing. These are followed by education, custom, government, real estate, and coin-op.

Growth in training, point-of-purchase, and military expenditures alone should be sufficient to guarantee the continued viability of the industry.

However, 1985 estimated industrial player sales will be a disappointment after earlier high expectations and high volumes generated by the arcade industry. This past year can best be viewed as a period of industry recouping, characterized by large increases in pilot project activity, but few full production roll-outs or network implementations.

All signs are positive that 1986 will be a watershed year for the technology. The videodisc industry has weathered the failure of RCA in the consumer market and the failure of the arcades as an industrial market. Now a number of significant, large projects are poised for full-scale implementation.

The price of videodisc and related technologies is dropping rapidly. Cost of production is also dropping. As these combined costs lessen, the videodisc continues to become an increasingly cost-effective alternative to other forms of information delivery in all application areas.

Medical Services Sub-Market. The medical market has great long-term potential. It has a multitude of strong needs that can be well met by interactive video. The market has a strong base of active suppliers in the form of pharmaceutical companies which are accustomed to spending large amounts of money and employing progressive marketing techniques in order to influence the medical community. The videodisc fits the bill.

In the medical community, much of the information base is highly visual and new visual information needs to be disseminated and absorbed in an efficient manner. Again, the videodisc is a perfect delivery device for this need. The report predicts the medical market will represent an annual software dollar volume of over \$94 million in 1990.

Factors Influencing Development and Use of Interactive Video in Nurse Education: A Delphi Study

This study was performed by Mary Anne Rizzolo as part of her recently completed doctoral program at SUNY in Brooklyn, NY. The purpose of the study was to identify factors impeding development and use of interactive video in nurse education in order to specify policies and procedures that would facilitate interactive video learning (IAVL) development and use.

Methodology. The opinion of nurse educators who have been involved in development of IAVL programs were solicited using the Delphi technique. The project consisted of three rounds of questionnaires. In the first round participants responded to open-ended questions. Responses from Round One were condensed into 95 Delphi items for the Round Two questionnaire. On Round Two, participants responded to statements by indicating their degree of agreement/disagreement on a five-point Likert scale. On Round Three, respondents received a copy of their own Round Two questionnaire with the addition of group feedback--frequency count, mean, and standard deviation. Participants reconsidered their responses in light of the group feedback and commented on statements, particularly if their response was in opposition to the majority of respondents. The final panel had 31 participants, 18 from academic environments, five from continuing education settings, and eight from the business sector.

Results. The nurse educators who participated in this study were able to identify obstacles to development and suggested ways to overcome them. The obstacles they named and the solutions they suggested were essentially the same as those which can be found in the instructional design literature. However, the participants did not state an opinion on a fairly large number of items. Ten or more respondents chose option three (neither agree nor disagree) for 22.6 percent of the statements on the questionnaire. This may indicate a lack of knowledge on some topics, or perhaps a lack of confidence in what they know about some issues.

Cost Factors. Most of the participants from academic settings offered educational solutions to obstacles, and were somewhat naive in relation to cost issues. On the other hand, respondents from continuing education and the business sector tended to be more practical and considered cost factors over and above all others when they wrote their initial responses on Round One, and when they responded to statements on the subsequent questionnaires.

Content. The subjects clearly identified the content they want in IAVL programs, and were especially united on application for simulations. They agreed on some applications for generic discs and testing/evaluation programs, but were not as sure about how they wish to use tutorials.

Benefits. The panel seemed to have a general sense of some principles of instructional design, but were not as knowledgeable about specific design issues using features of videodisc. They agreed on the benefits of IAVL programs for students, but were less certain about how IAVL programs might affect faculty roles, and were quite undecided about the specific measurable advantages of IAVL in terms of reduction in learning time and cost of training/education. The participants were conservative in their predictions about how IAVL might change nurse education in the future, and did not offer any novel ideas or innovative approaches for the technology.

Chapter 16

Resources

The following is a listing of various resources for the optical disc industry. The listings in each category are meant to be used as a starting point for inquiries, and are not necessarily comprehensive.

Periodicals

Actronics Reporter is published by Actronics, Inc., producers and marketers of the Actronics Interactive Video Learning System. This free publication covers topics of interest to users of the system and the American Heart Association CPR/ACLS courseware. Actronics, 810 River Avenue, Pittsburgh, PA 15212; 412/231-6200.

CD Data Report focuses on the development of compact disc-read only memory (CD-ROM). Published monthly by DDRI, 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682. Cost: \$295 per year.

CD-ROM Enduser is a magazine for buyers and users of CD-ROM products and services. Subscriptions are free to qualified readers. Published monthly by DDRI, Incorporated, 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682.

IBM MultiMedia Solutions is a promotional newsletter published by IBM Corporation's MultiMedia Solutions Division, PO Box 2150, Atlanta, GA 30055; 404/238-4646.

Interactive Media International Newsletter is a newsletter published in England by PLF Communications, Cross Street Court, Cross Street, Peterborough PE1 1UF England; 44/733-60535.

Interactive Healthcare Newsletter covers the development of videodisc, CD-ROM, digital optical disc and related technology in the health sciences. Published monthly by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. Cost: \$70 per year.

IICS Reporter is the newsletter of the International Interactive Communications Society (IICS). Free with membership. The IICS is an association of communications industry professionals dedicated to the advancement of interactive technologies. The Society provides a forum for users and vendors to share ideas, applications, and techniques for the effective use of interactive media. Executive offices located at 2120 Steiner Street, San Francisco, CA 94115.

The Laserdisk Professional is a journal devoted to optical disc technology in the library and information center markets. Published by Pemberton Press, 11 Tannery Lane, Weston, CT 06880; 203/227-8466.

The Lasertrader is a newsletter for those interested in buying, selling, and trading videodiscs. Consumer oriented. P.O. Box 2111, Huntington, WV 25721.

Medical Documentation Update reports on issues surrounding the medical records industry. Includes information on the use of digital optical discs and optical cards. Institute for Medical Records Economics, 121 Mount Vernon Street, Boston, MA 02108; 617/720-2229.

MegaBite: A Computing and Informatics Newsletter for Dental Educators contains equal parts DOS and Macintosh computer news, with the remainder devoted to general issues pertaining to dental informatics, including American Association of Dental Schools (AADS) infotech consortia news, courseware development, videodisc initiatives, and hardware/software compatibility issues. Subscriptions are \$20 for the year. Contact John Williams, Department of Oral Health, Health Sciences Center, University of Louisville, Louisville, KY 40292.

Memoires Optiques is an international videodisc, CD-ROM, and digital optical disk journal. Published monthly by ARCA Editions (France). Administrative office: *Memoires Optiques*, P.O. Box 303, 56007 VANNES CEDEX, FRANCE; phone 33.97.63.77.30.

Multimedia Computing, will be published quarterly beginning with the Winter 1990 issue and will provide end-user readers information that will help them implement and use multimedia computing. The subscription price is \$77 (personal subscriptions are \$29). Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967.

Nebraska Videodisc Design/Production Group News provides information on the activities of the Nebraska Group and the use of videodisc technology for education and training. Published quarterly by the Nebraska Group, KUON-TV, University of Nebraska-Lincoln, P.O. Box 83111, Lincoln, NE 68501-3111; 402/472-3611. Cost: Free.

Nursing Educators Microworld is a newsletter that reports on the use of microcomputer and videodisc instruction for nursing education. Published bi-monthly by Christine Bolwell, RN, MSN, 13740 Harleigh Court, Saratoga, CA 95070; 408/741-0156. Cost: \$54/year, half-price (\$27/year) for nurse educators.

Optical Information Systems magazine presents articles on the development and uses of optical media in publishing, teaching, storage, and training. Published bi-monthly by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Cost: \$95 per year.

Optical Information Systems Update (ISSN 0887-5162) is the companion newsletter to *Optical Information Systems* magazine and covers all optical-based storage media. Published twice monthly by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Cost: \$189.50 per year.

Optical Memory News is a detailed monthly industry newsletter that focuses on mass storage of data, storage of document images, and read-only and interactive videodisc applications. Cost: \$295 per year. Rothchild Consultants, 256 Laguna Honda Blvd., San Francisco, CA 94116; 415/681-3700.

The Videodisc Monitor (ISSN 0739-7089) covers application, innovation, and technology within interactive video, compact disc, and related fields. Published monthly by Fu-

ture Systems, Incorporated, Post Office Box 26, Falls Church VA 22046-0026; 703/241-1799. Cost: \$227 per year.

Books

Advanced Interactive Video Design (\$45). This publication reviews the latest applications of interactive videodisc technology, delineates design principals, and explains the steps to developing a videodisc program. Published in 1988 by Knowledge Industry Publications (ISBN 0-86729-0790X).

Authoring Systems (\$36.95). This book provides a guide for readers to compare, contrast, and select from dozens of computer packages that help users to program computer-assisted instruction. Published in 1988 by Meckler Corporation (ISBN 0-88736-0840X).

CD-I: A Designer's Overview (\$39.95). This 240-page book was written by Philips engineers and technicians and is an introduction to CD-I technology. The seven chapters cover the basics of the technology as well as proposed applications of the new technology. Published in 1988 by Kluwer Technical Books (The Netherlands) and distributed in the U.S. by McGraw-Hill, Suite 4-19, 11 West-19th Street, New York, NY 10011

CD-I and Interactive Videodisc Technology (\$24.95). Systems and applications experts explain how videodisc and CD-I formats are alike, how they differ, and what their co-existence means to designers, marketers, and users. Published by Howard Sams and Company in 1986 (ISBN 0-672-22513-1).

CD-ROM Handbook (\$59.95). A compendium of information on CD-ROM hardware, software, and manufacturing written by acknowledged experts in the industry. Chapters on CD-ROM and LANs, DVI, designing a CD-ROM information structure, artificial intelligence and expert systems, and more. Published in 1988 by Intertext Publications and McGraw Hill (ISBN 0-07-056578-3).

CD-ROM Yearbook: 1989-1990 (\$79.95). This is a dynamic sourcebook of facts, statistics, forecasts, articles, reviews, profiles, and analysis of the CD-ROM industry and its products. Includes articles, listings, and projections for and about CD-ROM and related technologies such as CD-I and DVI. Published in 1989 by Microsoft Press (ISBN 1-55615-179-9).

CD-ROM: The New Papyrus (\$21.95). Microsoft Press asked Bill Gates, David Hon, Rockley Miller, and other leading experts to submit their perceptions and recommendations on the technology and future of CD-ROM. Published by Microsoft Press in 1986 (ISBN 0-914845-74-8).

CD-ROM 2: Optical Publishing (\$20.95). This second volume from Microsoft Press is designed to give publishers, technical managers, and entrepreneurs a comprehensive, timely overview of the entire optical publishing process. (ISBN 1-555615-000-8).

Compact Disc-Interactive: A Designer's Overview (\$39.95). A detailed, comprehensive primer on the technology, design, and applications of CD-I. Published in 1988 by McGraw-Hill (ISBN 0-07-049816-4).

Digital Video in the PC Environment (\$39.95). A complete introduction to the combination of personal computer technology and digital audio/video. The book brings readers of diverse technological backgrounds up to date with current Intel Digital Video Interactive (DVI) technology. Published in 1989 by McGraw Hill (ISBN 0-07-039176-9).

The Disconnection: Interactive Video and Optical Disc Media (\$45). This book illustrates how interactive video is succeeding in point-of-purchase sales, employee training, classroom teaching, and information storage. Published in 1988 by Knowledge Industry Publications (ISBN 0-86729-218-0).

Educator's Handbook to Videodisc (\$22.95). Revised in 1987, this book presents basic facts about the technology, augmented with extensive appendices detailing available players, interfaces, monitors, peripherals, systems, educational titles, mastering options, authoring languages, and resources. Published by the Association for Educational Communications and Technology in 1987 (ISBN 0-89240-049-8).

The Compact Disc Book (\$12.95). Offers a history of the technology, guide to consumer players and discs, and a look at the future of the medium. Published in 1988 by Harcourt Brace Jovanovich, Inc. 111 Fifth Avenue, New York, NY 10003; 212/614-3000.

Interactive Optical Technology in Education and Training: Markets and Trends (\$39.95). Describes the current use of interactive optical technologies in the major education and training markets: industrial training, management/professional education, medicine, government, and public/higher/adult education. Published by Meckler Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967.

Interactive Video (\$24.95). Part of the Educational Technology Anthology Series, this book is a compilation of thirty articles that recently appeared in Educational Technology magazine dealing with interactive video. Published in 1989 by Educational Technology Publications (ISBN 0-87778-206-7).

Interactive Video (\$19.95). This book provides the basics of the technology and explains which training problems interactive video will solve. Describes step-by-step design, production, pre-mastering, review, and approval of the finished program. Published in 1988 by Educational Technology Publications (ISBN 0-87778-206-7).

Nursing Educators MicroWorld Volume One—Plus (\$37.95). Includes the first six issues of the newsletter of the same name, a list of discounted software, directories of IBM and Apple computer software, directory of videodisc courseware, and index, and other resources. Published by Diskovery, 13740 Harleigh Court, Saratoga, CA 95070; 408/741-0156.

Opening Minds: The Evolution of Videodiscs and Interactive Learning (\$29.95). A historical perspective on the use of technology in public education and a comprehensive chronology of videodisc technology from the 1890s to the present. Published in 1989 by Future Systems, Inc. (ISBN 0-8403-5191-7).

Practical Guide to Interactive Video Design (\$34.95) Disc veteran Nick Iuppa offers a blueprint of techniques for the design and production of interactive video programs. Shows how interactive video programs can be used in training, retail, educational, and other applications. Published in 1984 by Knowledge Industry Publications (ISBN 0-86729-041-2).

Should Schools Use Videodiscs? (\$35). The Institute for the Transfer of Technology to Education assembled this special report to help its members weigh the merits of interactive technology in the classroom. Published by the National School Boards Association in 1986.

Using Video: Interactive and Linear Designs (\$34.95). This book promotes the importance of good design in its treatment of 40 techniques that are both creative and practi-

cal. Includes 18 linear and 22 interactive techniques to help readers plan their own productions. Published by Educational Technology Publications in 1989 (ISBN 0-87778-199-0).

The Videodisc Book (\$25). Published in 1984 by John Wiley and Sons, this book contains a compilation of articles in the industry as well as a directory of production and development sources.

Videodisc Repurposing is a monograph written by Craig Locatis, PhD and published by the Lister Hill National Center for Biomedical Communications, a branch of the National Library of Medicine. Educational Technology Branch, Lister Hill National Center for Biomedical Communications, National Library of Medicine, Bethesda, MD 20894; 301/496-6280.

Videodisc Technology was written by Eldon Ullmer, PhD and published by the Lister Hill National Center for Biomedical Communications, a branch of the National Library of Medicine. It consists of four sections covering videodisc technology and formats, compact disc systems, and factors to consider when selecting a videodisc system. Educational Technology Branch, Lister Hill National Center for Biomedical Communications, National Library of Medicine, Bethesda, MD 20894; 301/496-6280.

Directories/Reference

CD-ROMs in Print: 1990 (\$37.50). A comprehensive listing of CD-ROM products, providers, and distributors. Published in 1989 by Meckler Corporation (ISBN 0-887636-359-8).

CD-ROM Sourcebook (\$725). This regularly updated manual is a thorough reference work of hardware, software, and services in the growing field of CD-ROM. Contains sections on mastering and replication, CD-ROM drives, CD-ROM systems, search software, data preparation, CD-ROM titles, interfaces and controllers, licensees, publications and articles, and consultants. Published by Diversified Data Resources, Inc., 510 North Washington Street, Suite 401, Falls Church, VA 22046-3537; 703/237-0682.

Complete Interactive Video Courseware Directory (\$60). This volume contains information on more than 250 interactive video available course for computer, electronics, financial, manufacturing, medicine, and sales/management. Published in 1989 by Convergent Technologies Associates.

IBM Multimedia Courseware Pocket Guide (G5804033). Contains a listing of In-fowindow Touch Display courseware and vendor sources for both custom and generic software. Available from local IBM marketing representatives.

Interactive Video Compatibility Guide (\$49). A long-awaited guide to compatibility for the videodisc industry. Contains clear and concise summaries of compatibility issues, cabling guides, hardware specifications, comparative tables, and pro-con evaluations of the most popular hardware components and systems. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-11-X).

Interactive Video Directory (\$65). Contains references to over 1000 producers, manufacturers, universities, and users of interactive video. Published in 1987 by Applied Interactive Technology (ISSN 0743-4537).

Interactive Video Primer: Medical Education (\$49). Provides an overview of the use of interactive video for medical education. Chapters include videodisc and videodisc hard-

ware, commercial courseware, medical schools, professional associations, research, and resources. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-13-6).

Interactive Video Primer: Nursing Education (\$39). Provides an overview of the use of interactive video for nursing education. Chapters include videodisc and videodisc hardware, commercial courseware, nursing schools, testing & certification, research, and resources. Published in 1990 by Stewart Publishing, Inc. (ISBN 0-936999-12-8).

International Directory of Interactive Multimedia Producers (\$35). Lists 350 companies and individuals who are in the business of creating and producing interactive multimedia. Published by Multimedia Computing Corp., 2900 Gordon Avenue, Suite 100, Santa Clara, CA 95051; 408/245-4750.

International Interactive Communication Society Membership Directory list the members of this professional society. Membership is \$50 per year for individuals.

Laser Videodisc Companion (\$16.95). A guide to the best and worst laser videodiscs. A 432-page volume which reviews 1200 entertainment, education, and imported discs. Published in 1988 by New York Zoetrope, 838 Broadway, New York, NY 10003; 800/242-7546 or 212/420-0590.

MedicalDisc Directory (\$90). A listing of more than 430 health-related videodisc projects and CD-ROM data bases. Updated annually. Published by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155.

Optical Information Systems Buyer's Guide & Consultant Directory. A listing of names and address of more than 5,000 contacts involved with optical information systems. Annual issue of journal with same name, available to subscribers from Meckler Corporation.

Software for Health Sciences Education: An Interactive Resource (\$45). A series of HyperCard stacks which describe educational computer software currently available to health science students and professionals. Published by Learning Resource Center, University of Michigan Medical Center, 1135 East Catherine, Ann Arbor, MI 48109-0726.

Sony View System Courseware and Authoring Guide catalogs videodisc programs that play on the Sony View system. Available from local Sony sales representatives.

Videodisc & Related Technology: A Glossary of Terms (\$7.95). The editors of *The Videodisc Monitor* have compiled a complete dictionary of over 500 definitions of key terms. Published by Future Systems, Inc. in 1986 (ISBN 0-938907-02-6).

Videodisc Compendium for Education & Training (\$12.50). Lists more than 600 videodisc titles in 36 subject areas, ranging from arts and literature, math and science, to career guidance and computer training. Published in 1989 by Emerging Technology Consultants, PO Box 12444, St. Paul, MN 55112; 612/639-3973.

The Videodisc Connection: A Directory of Service Suppliers is a free listing of vendors who provide videodisc design, production, mastering, programming, etc. Published by the Optical Recording Project/3M, Building 225-4s, 3M Center, St. Paul, MN 55144-1000; 612/733-2142.

Videodiscs in Education: A Directory lists videodiscs appropriate for the education marketplace. Published by the Minnesota Educational Computing Consortium, 3490 Lexington Avenue North, St. Paul, MN 55126.

Market/Research Reports

Electronic Retailing (\$250). Offers a comprehensive view of the emerging market structure and outlines objectives, opportunities, and pitfalls faced by industry participants. Published in 1986 by Knowledge Industry Publications.

CD-ROM Software: Textual Retrieval and Networking Issues (\$1990). An analysis of the CD-ROM software industry. Published in 1987 by Information Workstation Group, 501 Queen Street, Alexandria, VA 22314; 703/548-4320.

Key Vertical Markets: The Impact of Optical Publishing. Addresses the use of CD-ROM technology in five market areas: medical, financial, legal, marketing and demographics, and architecture/engineering. Published in 1987 by LINK Resources Corporation, 79 Fifth Avenue, New York, NY 10003; 212/620-3099.

Non-Consumer Market for Videodisc Technology (\$1800). This report predicts sales of non-consumer videodisc programs will rise in dollar value from \$140 million in 1987 to \$605.56 million by 1991. Hardware forecast to rise from \$209.25 million to \$453.06 million in the same period. Published in 1987 by Frost and Sullivan, 106 Fulton Street, New York, NY 10038; 212/233-1080.

Nursing Education, A Promising Market for Interactive Video (\$240). Provides a look at a market that spends an estimated \$10- \$18 billion annually on education and training. Chapters include an overview of the hospital and nursing school markets, penetration of microcomputers in nursing education, the emerging role of interactive video, factors affecting software and hardware sales, and sales projections for the 1990s. Included in the report are more than 50 charts and graphs detailing key figures and trends. Also included is a complete description of videodisc programs for nursing education. Published in 1990 by Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155.

Optical Disc Strategies for Electronic Publishers (\$750). Examines potential changes in electronic publishing from the emergence of optical discs in data distribution. Breaks the electronic publishing market into eight specific application areas and provides estimates of market size and shares, plus CD-ROM and videodisc player penetration in each area. Published in 1984 by LINK Resources.

Optical Technology's Impact on Paper, Microform, and Magnetic Disk and Tape Storage (\$1,500). This report describes the growth opportunities and applications for CD-ROM, CD-I, WORM, and erasable optical drives. Published in 1988 by Electronic Trend Publications (ISBN 0-914405-23-3).

State of the CD-ROM Industry: Applications, Players, and Products (\$1590). This two-volume set features market and technology forecasts, vertical market analyses, an industry directory, charts, and guidelines. Published in 1988 by Information Workstation Group, 501 Queen Street, Alexandria, VA 22314; 703/548-4320.

The U.S. Videodisc Market (\$795). Features a concise and thorough review of individual sub-markets and includes complete forecasts of sales, installed base, and growth rate of each submarket through 1990. Published in 1985 by Future Systems, Inc.

Use and Effectiveness of Videodisc Training (\$49.95). Surveys the results of comprehensive studies evaluating the effectiveness of interactive videodisc as a training medium.

Includes 30 studies by corporate, government, military, and educational users conducted between 1980 and 1987. Published in 1988 by Future Systems, Inc.

Videodisc in Electronic Selling (\$750). Examines the use of interactive videodisc in the point-of-purchase and electronic marketing industry. Includes an industry overview, case studies, vendor profiles, implementation strategies, and market projections. Published in 1984 by LINK Resources.

Videodisc Training: A Cost Analysis (\$49.95). Provides a cost comparison of classroom versus self-paced interactive instruction. Includes brief history of videodisc technology, guidelines for choosing your courseware delivery system, cost analysis, calculations for a sample course, and break-even analysis. Published in 1987 by Future Systems Inc.

Videodiscs in Museums (\$49.95). Features an international listing of museums that use videodiscs and a directory of resources. Published in 1987 by Future Systems, Inc.

Videodiscs in Healthcare: A Guide to the Industry (\$135). A complete desk reference on the use of optical disc technology in the healthcare industry. Contains a wealth of information on how interactive video is being used by companies, schools, and other organizations in the healthcare field. Published in 1989 by Stewart Publishing, Inc. (ISBN 0-936999-08-X).

Computer Software

Interactive Toolkit (\$104.50). This package for the PC is a workbook and software program that teaches novices to design and produce computer-based training and interactive videodisc programs. Included are models, worksheets, and flowcharts plus Arthur, a demonstration authoring system for MS-DOS computers. Published in 1987 by OmniCom Associates (ISBN 0-944650-01-5).

Training Cost Model (\$49.95). This program allows the user to insert base costs, training numbers, and other pertinent data—then it compares per-person training costs for interactive video or CBT versus traditional lecture-based courses. Published in 1988 by Future Systems Inc. (ISBN 0-938907-11-5).

Videotapes/Videodiscs

Interactive Healthcare Demos (VHS \$45) is a 90-minute tape containing videotaped demonstrations of the best commercial videodisc programs as well as award-winning programs by the National Library of Medicine, U.S. Navy, and various health sciences schools. Available from Stewart Publishing, Inc.

Creating Slice of Life (VHS \$45) is a 90-minute demonstration videotape which reviews the process of transferring medical images to videodisc and the educational applications designed using the University of Utah's *Slice of Life* videodisc. Available from Stewart Publishing, Inc.

Interactive Healthcare Demos II—Nursing (VHS \$35) is a 45-minute demonstration of four commercially available videodisc programs which are suitable for nursing education. Available from Stewart Publishing, Inc.

Interact 87 (Two VHS Videotapes, \$75). This video conference on interactive videodisc design features a demonstration of the award-winning Oxyacetylene Welding

simulator by David Hon (Ixon) and Greek Vases, an interactive exhibit by Interac Corporation for the J. Paul Getty Museum. Published in 1987 by the IICS.

Interactive Video Archive (VHS \$25) is compiled from tapes presented during the CAIV Showcase held in Atlanta at the annual Association for Educational Communications Technology (AECT) conference. Contact Dr. John F. Moore, Educational Technologies Division, Learning Resource Center, Old Security Building, Blacksburg, VA 24061.

Interactive Winner's Circle (VHS \$129, CLV Videodisc, \$149). This program is a teleconference sponsored by the IICS and the Nebraska Group in conjunction with the 1987 Nebraska Videodisc Symposium. Features presentations from the 1987 Nebraska Award winners. Published by the IICS. Available from Future Systems, Inc.

Optical Discs: An Information Revolution (Three VHS Videotapes, \$250). The IEEE satellite video conference took place in 1987 and brought together top experts in the field to examine the economics, technological and application trends and major players in the business. Published by the IEEE. Available from Future Systems, Inc.

Conferences/Workshops

Association for the Development of Computer-Based Instructional Systems (ADCIS), Miller Hall 409, Western Washington University, Bellingham, WA 98225; 206/676-2860. A professional association with many special interest groups (SIGs), including the Interactive Video-Audio SIG and the Health SIG. Both SIGs focus heavily on videodisc applications in the health sciences. Annual meetings held in November.

Fuld Institute for Technology in Nursing Education (FITNE), 28 Station Street, Athens, OH 45701; 614/592-2511. FITNE hosts workshops to teach interactive video development. The 4-1/2 day, hands-on workshops focus on design and authoring techniques. Working in small teams, participants actually develop an interactive lesson during the session. Participants will learn the *Quest* authoring system as well as the *Interactive Video Design Toolkit* program. Production and videodisc premastering techniques also are presented.

Health Sciences Communications Association (HeSCA), 6105 Lindell Blvd., St. Louis, MO 63112; 314/725-4722. Heavily oriented toward video production, HeSCA annual meetings, held in March, are increasingly including presentations on videodisc applications.

The Institute for Graphic Communication, 375 Commonwealth Avenue, Boston, MA 02115; 617/267-9425. Sponsors a series of small conferences, usually in Florida and California, on optical disc applications. Recent titles include "Outlook for Compact & Videodisc Systems and Applications" and "CD-I: Birth of a Billion Dollar Industry". Two and one half days of presentations.

Institute For Medical Record Economics, Inc., 121 Mount Vernon Street, Boston, MA 02108; 617/720-2229. Sponsors the Computerization of Medical Records conference annually in the spring. Three days of presentations, including the use of optical discs.

Learned Information, Inc., 143 Old Marlon Pike, Medford, NJ 08055; 609/654-6266. Sponsors the Optical Publishing conference (USA) and the Optical conference (Amsterdam 1987). Three days of presentations and exhibits.

Meckler Publishing Corporation, 11 Ferry Lane West, Westport, CT 06880; 203/226-6967. Sponsors the Optical Information Systems (OIS) conference held annually in December. OIS is three days of conference sessions and exhibits.

Nebraska Videodisc Design/Production Group, KUON-TV/University of Nebraska-Lincoln, P.O. Box 83111, Lincoln, NE 68501; 402/472-3611. Sponsors the Nebraska Videodisc Symposium annually in September. Three days of presentations and exhibits. Also sponsors a series of Nebraska Videodisc Workshops where participants actually design and produce an interactive videodisc. Offers Basic, Intermediate, and Advanced workshops several times a year.

Online International Inc., 989 Avenue of the Americas, New York, NY 10018; 212/279-8890. Sponsors CD-I/The Future conference, held May 1987 in San Francisco. Two and one-half days of presentations.

Rothchild Consultants, 256 Laguna Honda Blvd., San Francisco, CA 94116; 415/681-3700. Sponsors a series of conferences on optical storage technology. Recent titles include "Optical Storage for Small Systems" and "The Future of Optical Memory Technology". Three days of presentations.

Society of Photo-Optical Instrumentation Engineers (SPIE), P.O. Box 10, Bellingham, WA 98227; 206/676-3290. Sponsors the Optical Mass Data Storage conference, the 1986 program held in October in San Diego. Four and one-half days of conference sessions and exhibits.

Stewart Publishing, Inc. 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. Sponsors periodic symposia and conferences on videodisc, optical disc, CD-ROM, and related technology—including the Interactive Healthcare conference held in June each year. Three days of presentations, exhibits, and workshops.

Symposium Computer Applications in Medical Care (SCAMC), c/o Continuing Medical Education, George Washington University, 2300 Eye Street, NW, Washington, DC 20037; 202/994-8928. The annual SCAMC meeting is designed to inform physicians, healthcare administrators, biomedical scientists, engineers, nurses, and other healthcare professionals about current and potential applications of computer technology to healthcare and to identify areas of research and development that need to be addressed. Annual meeting held in November.

Associations/Special Interest Groups

Association for the Development of Computer-Based Instructional Systems (ADCIS), Miller Hall 409, Western Washington University, Bellingham, WA 98225; 206/676-2860. A professional association with many special interest groups (SIGs), including the Interactive Video-Audio SIG and the Health SIG. Both SIGs focus heavily on videodisc applications in the health sciences.

British Interactive Video Association, is a professional group bringing together about 40 British companies who have made an interactive videodisc. The organization is funded by contributions from its members. For information about the BIVA, contact the National Interactive Video Centre, 24-32 Stephenson Way, London NW1 2HD; 1/387-2233.

Fuld Institute for Technology in Nursing Education, 28 Station Street, Athens, OH 45701; 614/592-2433. Funded by the Helene Fuld Health Trust, the Institute serves as a

clearing house for both hardware and software related to the use of computer and interactive video technology in nursing education. FITNE makes use of newsletters, electronic bulletin boards, and a telephone support service.

Health Sciences Communications Association (HeSCA), 6105 Lindell Blvd., St. Louis, MO 63112; 314/725-4722. Heavily oriented toward video production, HeSCA meetings are increasingly including presentations on videodisc applications.

Healthcare Interactive Videodisc Consortium (HCIVC). Organized in 1988 by IBM Corporation, the HCIVC consists of 14 medical and nursing schools in the US and Canada who have entered into a contract to develop five videodisc modules each on health sciences topics. In return for developing these programs, IBM provides some technical and hardware support. The programs will be made available for distribution. For more information, contact Paula O'Neill, HCIVC Chairperson, Instructional Resources, The University of Texas, MD Anderson Cancer Center, 1515 Holcombe Blvd., Houston, TX 77030; 713/792-6730.

Health Sciences Consortium, 201 Silver Cedar Court, Chapel Hill, NC 27514; 919/942-8731. The HSC is a nonprofit cooperative created in 1971 to enable health sciences institutions to share instructional materials. The HSC will be distributing some of the HCIVC programs. Membership is \$1,000 per year.

Interactive Healthcare Consortium, c/o Stewart Publishing, Inc., 6471 Merritt Court, Alexandria, VA 22312; 703/354-8155. The Interactive Healthcare Consortium (IHC), formerly the MDR Videodisc Consortium (MDRVC), is an educational publishing cooperative dedicated to the development and distribution of interactive videodisc courseware in the health sciences. Membership includes schools of medicine, nursing, dentistry, allied health, pharmacy, and public health as well as hospitals, professional organizations, and pharmaceutical companies. Membership is \$300 per year (\$150/year for schools of nursing). Members receive the Interactive Healthcare newsletter (published monthly) and discounts on the purchase of videodisc courseware, hardware, and authoring tools.

Interactive Video Industry Association (IVIA), 1700 North Moore Street, Suite 1905, Arlington, VA 22209; 703/408-1000. The IVIA is a trade association serving the interactive video industry by promoting interactive video technology to business and government and by working toward the establishment of universal industry standards. The IVIA is the administrative body of Tech 2000, a showcase for interactive media located in the Techworld Trade Center in Washington, D.C.

International Interactive Communications Society (IICS), 2120 Steiner Street, San Francisco, CA 94115; 415/922-0214. A professional association which promotes the use of interactive communications in business, industry, medicine, education, and the arts through the sharing of ideas, information, and experiences. There are 25 established and organizing chapters located throughout the U.S., Canada, England, France, and Germany.

Medical Interactive Video Consortium (MIVC). The MIVC was formed in 1987 to increase the effective use of interactive video in medicine and medical education. For more information, contact the MIVC c/o Frank Toth, Uniformed Services University of the Health Sciences (USUHS), 4301 Jones Bridge Road, Bethesda, MD 20814; 202/295-6261.

CONVINCE (Consortium of North American Veterinary Interactive New Concept Education) is a not-for-profit organization allied with the American Veterinary Medical Association. The primary purpose of CONVINCE is to encourage cooperative development and

sharing of interactive video and hypermedia programs for veterinary medical education. For more information about CONVINCe, contact Dr. W.F. Keller, President, College of Veterinary Medicine, Michigan State University, East Lansing, MI 48824-1316; 517/355-7624.

Film Festivals/Awards

Nebraska Awards. Each year videodisc awards are made at the Nebraska Videodisc Symposium. Award categories are Best Educational Achievement, Best Industrial/Military Training Achievement, Best Consumer Achievement, Best Data Bank Achievement, and Best Overall Achievement. In 1984, two health-related videodisc projects received honors The University of Iowa's *Assessment of Neuromotor Dysfunction In Infants* and the University of West Florida's interactive training system to teach skills to social workers. 1986 recipients included two health-related productions which shared the Best Educational Achievement award. They were *Shotgun Wound to the Abdomen* by Intelligent Images, Inc. and *The Case of Frank Hall* by the National Library of Medicine.

In 1987, three health-related production received awards. *Combat Trauma Training* (U.S. Navy) received the Best Overall Production award, *Introduction to Cardiovascular Examination* (Mirror Systems) received the Best Education Production award, and *The Suicidal Adolescent* (National Institute of Mental Health) received an Honorable Mention. 1988 recipients included three health-related videodisc projects which received Certificates of Merit this year: *A Right to Die? The Case of Dax Cowart*, submitted by the Center for Design of Educational Computing, Carnegie Mellon University, Pittsburgh, Pennsylvania, *Recognition & Management of Abdominal Conditions*, submitted by Lunaria Incorporated, and *The Second Slice of Life*, submitted by the University of Utah, Salt Lake City, Utah.

John Muir Medical Film Festival, 1601 Ygnacio Valley Road, Walnut Creek, CA 94598; 415/947-5303. Three medical videodiscs were pronounced award-winning productions by the judges of the 1986 John Muir Medical Film Festival. In all, there were 33 winners and 43 Silver Certificate Award recipients in a contest that involved more than 400 entries from across the United States and eleven foreign countries. All entries were placed in one of more than 50 medical content categories and judged based on content, production value, and instructional design.

Shotgun Wound to the Abdomen the now familiar production done by the Lunaria group for Intelligent Images, Inc. was the winner in the Emergency Medicine category. Two other videodiscs received second place Silver Certificate Awards: *The Case of Frank Hall*, produced by the National Library of Medicine, and *The Active Knee*, produced by the Alive Center with the Sandy Corporation. The winning productions from the festival were shown at the National Library of Medicine in Bethesda, Maryland as part of the library's 150th Anniversary Celebration in October.

Association of Visual Communicators (AVC) Cindy Awards. As an adjunct to the CINDY Awards competition, AVC hosted a month-long Showcase of Interactive Videodisc Technology. The Showcase featured hands-on demonstrations of a broad range of computer/videodisc systems, including those offered by IBM, Sony, Pioneer, and Visage. More than 35 videodisc programs were entered, four having a health care theme. These were the *BioSci Videodisc* by Videodiscovery, *The Active Knee* by the ALIVE Center, *The Challenge of Antibiotics* by Lancit Media Productions, and *Abdominal Stab Wounds: Donnie Brooks* by Intelligent Images.

The Interactive Videodisc category was introduced into the AVC CINDY competition for the first time in 1985. Gold, Silver, Bronze, Honorable Mention, and Special Achievement Awards are given in various categories. 1986 health-related winners were *Abdominal Stab Wounds*, which won a Gold award in the Education category, and *the BioSci Videodisc*, which was presented a Special Achievement Award for pioneering work in visual database.

Demonstration Centers/Clearing Houses

National Library of Medicine

The National Learning Center for Interactive Technology opened in March 1985 at the National Library of Medicine as a central location where various computer-video information and educational technologies are demonstrated, reviewed, and evaluated. The Learning Center a hands-on laboratory where visiting medical educators and scientists can explore the comparative applications and various uses of interactive educational technology in the health sciences. The Center is part of the Lister Hill National Center for Biomedical Communications, the branch of the Library responsible for conducting research in health communications.

The staff of the Learning Center acquire working prototypes and commercially available products for health science education. Visitors are encouraged to try out the programs and study the assumptions underlying their design. The Learning Center staff provide individual and small group tutorials and demonstrate the diversity of courseware and the alternative approaches available when designing interactive programs.

The Learning Center's collection consists of courseware for use with microcomputer systems, often in conjunction with touchscreen, bar code reader, digital speech, voice recognition, CD-ROM, reflective videodisc, and write-once optical disc technology. The following are some of the videodisc and CD-ROM applications housed at the Learning Center for Interactive Technology:

The NLM Video Picture List demonstrates the use of videodisc technology as a visual database and catalog of pictures from the NLM History of Medicine collection.

The Microanatomy Video Library takes the concept of the visual database to the next technology level. Over 2,000 microanatomical images located on a videodisc are accessed by the user through a free-text database program running on an attached microcomputer.

The Anatomy of the Knee contains a library of anatomic, magnetic resonance, and computer tomography images of the human knee in three planes (sagittal, axial, and coronal). These images can be used under computer control to compare anatomical and electronic images of the knee in all three planes. A series of test questions is included to assess the student's mastery of this content area.

Visual Database with Barcode Access demonstrates the use of barcodes for the random selection access of videodisc images and sound. With texts retrofitted with barcodes, or with texts specifically designed to incorporate them, the student has the flexibility of augmenting the information provided by the text as needed.

Medical Emergency Simulation with Touchscreen (DxTER) is a Level III application with touchscreen developed by Intelligent Images, Inc. The simulation is a realistic, highly interactive emergency situation done in real time.

Teenage Suicide Prevention is an application for mental health students to help raise their consciousness level concerning the hidden signs of an impending teenage suicide. This videodisc program includes a series of simulations of depressed adolescents.

Technological Innovations in Medical Education (TIME) are voice-activated patient management simulations. The microcomputer is trained to recognize the user's voice with a selected vocabulary of medical words and phrases which provide the basis for interacting with the program.

AI/RHEUM is an artificial intelligence consultant system in rheumatology intended for the use of practicing physicians not having specialty training in that field.

PathMac was developed at Cornell University and demonstrates the concept of hypertext/hypermedia. The program is Macintosh-based and uses a recordable WORM videodisc for the delivery of conventional video images and the computer's hard disk and screen for the delivery of digitized images.

The Echocardiography Videodisc Encyclopedia was developed with Yale University and is a videodisc-based library of echocardiographs. The accompanying program uses a hypermedia environment to teach echocardiographic image interpretation using online text, animated graphics, and digitized sound.

The Electric Cadaver was designed at Stanford University as a general prototype of electronic multimedia books. Using the Macintosh computer in a hypermedia environment, the system displays images on two screens. The text, graphics, and video are extensively cross-referenced, making it possible for a user to jump from picture to text to video and back.

Medline on CD-ROM demonstrates the use of Compact Disc-Read-Only Memory technology. A subset of the Medline database and an associated search algorithm are stored on a compact disc for quick and easy access.

The National Board of Medical Examiners' CBX System is a series of interactive patient simulations. Each CBX case presents a simulated patient in an uncued, patient management environment. The student is expected to diagnose, treat, and monitor the patient's condition as it changes over time and in response to treatment.

Computer-based Curriculum Delivery System in Pathology is a series of 10 videodisc lessons developed at Lister Hill and designed for use in the medical school basic pathology curriculum.

E.T.Net Electronic Bulletin Board is billed as "an online computer conference dedicated to users of computers in medical education." E.T.Net is designed to electronically link developers and users of interactive technology in health care education. Its primary purpose is to help alleviate a major problem faced by medical educators today, i.e. the lack of good information on medical interactive courseware. E.T.Net provides information on what courseware is available, where it can be obtained, which programs are useful, and what needs to be developed.

Users of E.T.Net are able to share software, hardware, and videodisc reviews; information on current and upcoming courseware and videodiscs; and news on new applications of interactive technology in medical education. E.T.Net is open to professionals engaged

in either the development or use of interactive technology in medical education. It is available at no cost, 24-hours a day, seven days a week, 365-days a year. The service may be accessed via the Telenet network by a local phone call to your local Telenet node. The Telenet address is 301 565. To register for your fee account, call E.T.Net and gain access by typing etnet in lower case letters. E.T.Net will provide further instructions. Help and a User's Guide are available online. A pocket Quick Reference Guide may be requested from the Learning Center for Interactive Technology.

TECH 2000

The Interactive Video Industry Association (IVIA), in conjunction with Techworld developer International Developers Inc. have established the Tech 2000 showcase and gallery in Techworld Plaza, Washington, DC. Billed as a museum of the future, Tech 2000 is the first major interactive information technology demonstration site open to the general public. The Techworld World Technology Trade Center is strategically located between the Capitol and the White House and directly opposite the Washington Convention Center. Tech 2000 occupies 10,000 square feet and provides a high-profile center for the display and interpretation of emerging technologies, with an emphasis on interactive systems and media.

Tech 2000 houses award-winning programs and new product introductions. The exhibits are accessible through self-guided tours (for walk-in visitors), guided tours (for focus groups from various user markets) and in-depth demonstrations of specific interactive programs. Staff members are available to answer questions and give more detailed explanations to visitors. (901 Eighth Street, NW, Washington, DC 20001; 202/682-2190.)

Smithsonian Institution

The National Demonstration Laboratory for Interactive Educational Technologies (NDL) has been established as a cooperative effort of the Smithsonian Institution and the Interactive Video Consortium (IVC), an organization of public broadcasting stations. The center, located within the Smithsonian's National Museum of Natural History, will be available to leaders in the fields of museology, education, publishing, and broadcasting, as well as legislators and public policy specialists.

According to Glen Hoptman, Director of the NDL, "The NDL is a technical assistance center to support individual efforts in the broad field of education. It is also a research and development center where we will look at issues and develop applications, explore the further reaches of interactive educational technologies and electronic publishing. We will also sponsor collaborative efforts among universities through the research consortium which we have established, and anticipate a quarterly publication called the *Journal of Hypermedia Studies*.

The Center is industry supported and is accepting donations of appropriate hardware systems and software programs to exhibit. The NDL opened on February 24, 1987. For more information or to schedule a visit, contact Glenn Hoptman, Director, National Demonstration Laboratory, Smithsonian Institution, Washington, D.C. 20560; 202/357-4748.

University of Calgary Nursing

As host of the 1985 International Symposium on Nursing Use of Computers and Information Science, the Faculty of Nursing in The University of Calgary recognized the need for promotion of Computer-Assisted Learning and Computer-Assisted Instruction in the nursing field. The lack of a dissemination centre for nursing computer courseware has prompted the Learning Resource Center (LRC) in the Faculty of Nursing and the Canadian Centre for Learning Systems (CCLS) to form a clearinghouse for computer software.

The aim of the Center is to provide exposure of computer courseware provided by software companies in the following areas: 1) Nursing clinical practice 2) Nursing education 3) Nursing research, and 4) Nursing administration or management. The LRC and CCLS currently have a variety of microcomputers and are requesting help in forming and updating this database centre. For additional information, contact the University of Calgary, Faculty of Nursing (LRC), Room 415, Bio-Science Building, Calgary, Alberta T2N 1N4, CANADA.

UK National Demonstration Center

The National Interactive Video Centre (NIVC) was established in September 1984 in London in response to the widely expressed wish for an independent and neutral focal point of activity regarding interactive video. The intention of the Centre is to provide a base where trainers, educators, and others can explore the technology while they are still in the early stages of decision-making.

The Centre is a result of a collaborative venture, established under the auspices of the Council for Educational Technology for the UK, with financial support from the Department of Trade and Industry, the Manpower Services Commission, and two major companies involved in the manufacture of hardware, Philips and Thorn EMI. Services provided include: 1) collection of literature on interactive video, 2) collection of case studies in interactive video, 3) register of research, 4) workshops and seminars, 5) consultancy, 6) systems display area, and 7) monthly meeting of videodisc designers. For more information, contact the National Interactive Video Centre, 24-32 Stephenson Way, London NW1 2HD, England, UK; 01/387-2233.

Videodisc Mastering Companies

- **LaserVideo**, 1 East Wacker Drive, Chicago, IL 60601; 312/467-6755.
- **Pioneer Video, Inc.**, 600 E. Crescent Ave., Upper Saddle River, NJ 07458; 201/327-6400.
- **Sony Communications**, Sony Drive, Park Ridge, NJ 07656; 201/930-6177.
- **Technidisc**, 2250 Meijer Drive, Troy, MI 48084, 313/435-7430 or 800/321-9610.
- **3M Optical Recording Project**, 3M Center, Building 223-56, St. Paul, MN 55144; 612/733-2142.

CD-ROM Mastering Companies

- **American Interactive Media**, 11111 Santa Monica Blvd., Suite. 700, Los Angeles, CA 90025; 213/473-4136.
- **Denon Digital Industries**, 1380 Monticello Road, Madison, GA 30650; 404/342-3032.
- **Digital Audio Disc Corp.**, 1800 N. Fruitridge Avenue, Terre Haute, IN 47804; 812/466-6821.
- **Discovery Systems**, 555 Metro Place North, Suite 325, Dublin, OH 43017; 614/761-2000.
- **Hitachi America Ltd.**, 950 Elm Street, San Bruno, CA 94066; 415/872-1902.
- **JVC America Disc Inc.**, 1621 Browning Avenue, Irvine, CA 92714; 714/261-9490.
- **Laser Logic**, 222 Railroad Avenue, Danville, CA 94526; 415/831-3646.
- **LaserVideo Inc.**, 1 East Wacker Drive, Chicago, IL 60601; 312/467-6955.
- **PDSC**, 2511 Graden Road, Building C, Monterey, CA 93940; 408/372-2812.
- **Philips/DuPont Optical**, Barley Mill Plaza, Building 21, Wilmington, DE 19898; 302/992-3142.
- **Polygram**, 11111 Santa Monica Blvd., Suite 1000, Los Angeles, CA 90025; 213/656-3003.
- **Quantum Access, Inc.**, 1700 West Loop South, Suite 1460, Houston, TX 77027; 713/622-3211.
- **Sanyo**, 200 Riser Road, Little Ferry, NJ 07643; 201/641-2333.
- **Sony**, 1359 Old Oakland Road, San Jose, CA 95112; 408/280-0111.
- **3M**, 3M Center 223-5S-01, St. Paul, MN 55144; 612/733-5211.



Glossary

ANALOG INFORMATION: Data that has a steady flow from one value to another--a continuous range of value. Films and videotapes store analog information as opposed to digital information, which is stored on computer floppys. **Analogy:** An analog clock has minute and hour hands that have a sweeping movement--a continuous range of motion. A digital clock changes by the minute or second in discrete units.

ARCHIVAL: Of, in, or containing archives--records, documents, photographs, etc. Archival laserdiscs may store medical records, X-rays, medical databases, or any other information for later retrieval.

ARTIFICIAL INTELLIGENCE: A computer-driven program that, in effect, learns from its experience, therefore improving its performance over time. This type of adaptation is normally associated with human intelligence. An example would be a program to help physicians diagnose patients that becomes more sophisticated with each case--remembering and building on the "experience" it gained from all previous cases combined.

AUTHORING LANGUAGE: A code system uniquely suited for programming instruction--simplifies and short-cuts computer-programming with PROGRAMMING LANGUAGES. Although they use plain-English commands, authoring languages do not prompt the author and are usually cumbersome for non-programmers. **AUTHORING SYSTEMS** are better suited to the non-programmer.

AUTHORING SYSTEM: A code system for programming instruction, designed to be used by non-programmers. Authoring systems prompt authors to enter instructions in plain English and have underlying programs controlling actual computer programming.

BAR CODE: A block of parallel lines which are read by a scanner or wand and send codes to a computer. Now appear on almost all food packaging. Also used by the American Medical Association and the National Library of Medicine in textbooks and on other material to provide access to a laserdisc player.

BRANCHING: A common element of interactive videodisc instruction where the program jumps from one area of instruction to another. For example, when a learner selects from a multiple choice question on the screen, the program will "branch" to different areas of the lesson depending on the learners choice.

CAD: Computer-Aided Design.

CAI: Computer-Aided (or assisted) Instruction.

CAL: Computer-Aided Learning.

CAPACITANCE VIDEODISCS: Two incompatible systems that use a stylus or sensor to read recorded data. Electrical, not optical systems. Operate by storing an electrical charge which is picked up by the stylus. See also CED and VHD.

CAV: Constant Angular Velocity. A videodisc format where the disc rotates at a constant speed at all times (1800 rpm). Up to 30 minutes of motion video may be stored on

a 12-inch videodisc using this format. Also permits freeze-frame and slow motion options on playback. See also CLV.

CD: Compact Disc. 12-centimeter (4.75 inches) laserdisc that stores digitally-encoded information in CLV format. Well-known as the popular format for commercial music.

CD-I: Compact Disc-Interactive. Announced in March 1986, CD-I is to be fully compatible with CD and CD-ROM formats, while, at the same time, adding a few capabilities. CD-I video will be stored in digital form, and may be played back as full-frame stills or reduced motion (1/9 of screen size and only 6 frames/second). Audio will be stored in seven modes with four different quality levels. The CD-I will be marketed as a self-contained viewing unit and is expected to impact heavily on the education and entertainment markets.

CD-ROM: Compact Disc-Read Only Memory. Sometimes CD-ROM. A 12-centimeter laserdisc that stores digitally-encoded information in CLV format. Differs from CDs in the amount of error-correction information encoded. Used heavily for the storage of large medical databases--holds about 550 megabytes of data.

CD-V: Compact Disc-Video. Another compact disc format, announced in 1987, that will hold five minutes of analog video and up to 20 minutes of conventional CD audio.

CED: Capacitance Electronic Disc. A grooved videodisc that requires a stylus ("needle") to read information. Not an optical system. Developed by RCA and marketed to the consumer/home market as SELECTAVISION. Discontinued by RCA in 1984.

CHAPTER STOP: Code which can be imbedded in a videodisc to signal the break between two separate chapters. Allows specific chapters to be accessed using the chapter search control of the videodisc player.

CHECK DISC: A videodisc used to confirm the placement and quality of recorded data. Usually inferior in quality to the final product.

CLV: Constant Linear Velocity. One of two formats for reflective optical videodiscs, CLV permits twice as much play time than CAV--up to one hour per side. CLV discs rotate at speeds that vary from 600 rpm to 1800 rpm, depending on the portion of the disc being read. CLV discs can not provide freeze-frame or slow motion playback options.

COMPACT DISC: See CD.

COMPACT DISC-READ ONLY MEMORY: See CD-ROM.

COMPACT DISC-INTERACTIVE: See CD-I.

COMPACT DISC-VIDEO: See CD-V.

COMPACT VIDEO DISC: See CVD.

COMPOSITE VIDEO: The various elements needed to produce a color video single-used by television sets. Includes chromatic and luminance picture information, blanking pedestal, field, line, and color sync pulses, and field equalizing pulses. As opposed to RGB display--used in color computer monitors--comprised of red, green, and blue signals. See also RGB.

COMPRESSED AUDIO: See STILL-FRAME AUDIO.

CVD: Compact Video Disc. Introduced by Interactive Video Systems, the CVD is a 12 cm disc able to hold 20 minutes of analog video in CLV format, 12.5 minutes in CAV

mode, or 22,000 still frames. Will also be compatible with CD audio format. Not a product of Philips/Sony who develop all of the compact disc formats.

DIGITAL INFORMATION: Information expressed in binary form--on or off, ones or zeros. Computers work with digital information. As opposed to analog information.

DIGITAL OPTICAL DISC: Technically, all forms of optical disc that store digital information, such as the CD and CD-ROM, are considered digital optical discs. However, the 12- and 14-inch optical discs used to store records and documents in digital form are often referred to as digital optical discs to distinguish them from other formats..

DIGITAL VIDEO INTERACTIVE: See DVI.

DRAW: Direct-Read-After-Write. Optical disc technology that permits discs to be recorded in local environments such as hospital departments. DRAW discs may be recorded once and not erased. However, data may be recorded onto the disc in small increments over a period of time until the disc is full.

DVI: Digital Video Interactive: Announced March 1987, the DVI compresses digital video information to hold 72 minutes of full-motion, full-screen video. DVI was developed by General Electric/RCA.

EIDS: Electronic Information Delivery System. The hardware configuration selected by the Department of Defense for delivery of their interactive videodisc materials.

EMULATOR: A system designed to simulate interactive videodisc programs before mastering. Uses computer-controlled videotapes to simulate the final disc operation.

EXTERNAL COMPUTER: Any computer of any size which is connected to a disc player via some sort of cabling device. As opposed to an ONBOARD MICROPROCESSOR with limited processing capability contained in Level II videodisc players.

FRAME: A single picture or image on a videodisc.

FRAME ADDRESS: See FRAME NUMBER.

FREEZE FRAME: A single frame from a motion sequence that is held motionless on the screen. Should be distinguished from a STILL FRAME, which is a single frame meant to be shown without motion--such as a slide or photograph which has been transferred to videodisc.

GENERIC VIDEODISC: Videodisc which contains a collection of material--usually slides, short motion sequences, etc.--on a topic or topics. Generic discs are intended to provide material with which others may program their own instructional or reference material, and is not usually sold with accompanying computer programs or course of instruction. An early proponent of this approach was the University of Washington Health Sciences Learning Resources Center.

GRAPHIC OVERLAY: See OVERLAY.

INTERACTIVE: A computer or video application involving the participation and input of the user to determine the direction and flow of information. INTERACTIVE VIDEO involves a videodisc player or random-access videotape player--often under computer control. As opposed to LINEAR, which proceeds from beginning to end without user input or control.

INTERACTIVE VIDEO: See INTERACTIVE.

INTERFACE: The link between two pieces of equipment, ie. between a computer and videodisc player. The INTERFACE DEVICE provides communication between the two, allowing them to "talk" to each other.

ISD: Instructional Systems Design.

IVD: Interactive Videodisc

KEYPAD: A hand-held device--similar to a remote control used for television sets--which contains alphanumeric and other keys. Used to communicate with a computer or videodisc player.

KIOSK: A stand-alone display used to house a computer and/or videodisc player, monitor, and input devices (keypad, touchscreen, etc.). Usually located in public access areas and used to dispense advertising, promotional, or other information. Associated with POINT-OF-PURCHASE, and POINT-OF-SALE applications.

LASER: Light Amplification by Stimulation of Emission of Radiation. In laserdisc systems, a low-power laser is used to read microscopic pits which contain the coded material.

LASERCARD: A credit-card-sized plastic card with a metallic strip on which data can be stored and read using a laser source. LaserCard is a trademark of the Drexler Technology Corporation. A LaserCard holds up to 1 megabyte of information and is being used by a few companies to store medical histories and other medical records.

LASERDISC: Also Laser Disc. Common or generic name for REFLECTIVE OPTICAL VIDEODISCS. The word form "LaserDisc" (no space, capital D) is a trademark of Pioneer Electronics for its reflective optical videodisc products.

LASERFILM: Form of optical disc that consists of a photographic film base and is read with a laser that passes through the disc (TRANSMISSIVE). Trade name for McDonnell Douglas Electronics Company.

LASERVISION: The trade name for the reflective optical videodisc format used by Pioneer, Philips, Hitachi, and others. LaserVision videodiscs have become the industry standard.

LEVELS OF INTERACTIVITY: Three degrees of interactivity for videodisc systems. Proposed by the Nebraska Videodisc Design/Production Group in 1980.

Level I involves use of the videodisc player controls only--still/freeze frame, picture stop, chapter stop, frame address, and dual-channel audio features--with little or no processing.

Level II is controlled by a small microprocessor built into some videodisc players. Level II videodiscs have small "data dumps" in them that are loaded into the processor when the disc is played. Level II provides some programming features such as branching at multiple choice questions, continuous video loops, and the like.

Level III consists of the Level I or Level II players interfaced with an external computer. Level III, like level II, provides programmed instruction. However, because the capabilities of the external computer are greater than the processors in Level II players, Level III programs can be far more sophisticated. Computers commonly used in Level III systems are IBM PC (and compatibles) and the Apple computers.

LIGHT PEN: A small, pen-like input device used to interact with videodisc or computer programs. The user touches the screen or monitor with the light pen.

LINEAR: Programs meant to be played from beginning to end without input or interruption. Most films and videotape programs are linear.

MASTER: Either 1) the original tape or film used to make copies or 2) the process of producing a "master" videodisc from which all other copies are replicated.

MENU: In a videodisc program, the menu provides a listing of options available to the user--much like a table of contents. Often there is a series of sub-menus as well.

NTSC: National Television Systems Committee that prepared the commercial standards for color broadcasting. NTSC standards are used in the United States, while PAL format is used in Europe, with the exception of France, which uses SECAM format. These formats are not compatible--PAL videodiscs will not play on NTSC standard players.

OMDR: Optical Memory Disc Recorder. A line of videodisc recorders made by Matsushita Panasonic. Many hospitals have installed the OMDRs to record the various medical imaging formats directly to disc.

ONBOARD MICROPROCESSOR: Small microprocessor built into Level II videodisc players. Programming code from the videodisc is "dumped" into the processor and permits a greater level of interactivity than players with out the processor, but less than players connected to an EXTERNAL COMPUTER.

OPTICAL DIGITAL DATA DISC: Refers to any optical disc used to store digital information.

OPTICAL DISC: Technically, any disc format that uses a light source, usually a laser, to read and write information. See also Digital Optical Disc.

OPTICAL MEMORY: A generic term for technology that stores and reads information through the use of a light source, usually laser. Includes the terms optical disc, laserdisc, videodisc, CD, CD-ROM, CD-I, and LaserCard.

OROM: Optical Read-Only Memory. A 5.25-inch laser-encoded optical memory storage medium. The concentric circle format and constant angular velocity (CAV) of the OROM gives it a faster access time than CD-ROM discs, but less storage space (250 MB instead of 550 MB).

PAL: Phase Alternation Line. The European standard for color television, except in France. Not compatible with the U.S. standard, NTSC.

PICTURE STOP: The ability of some videodisc players to stop on a specific frame during play. Also the instruction encoded in the disc to cause it to stop on the predetermined frame.

POI: See Point-of-Information.

POINT-OF-INFORMATION: See Point-of-Purchase.

POINT-OF-PURCHASE: Interactive video systems (often housed in a kiosk) set up in public places to demonstrate products or encourage sales. Also Point-of-Information (POI) and Point-of-Sales (POS).

POINT-OF-SALE: See Point-of-Purchase.

POP: See Point-of-Purchase.

POS: See Point-of-Purchase.

PRE-MASTERING: The stage of producing a videodisc where the master videotape is checked and prepared for final transfer onto the master disc. Master videotapes are usually 1-inch Type C NTSC helical.

PROGRAMMING LANGUAGE: Multipurpose codes used by programmers to communicate instructions to a computer. Common programming languages include BASIC, COBOL, FORTRAN, Pascal, and C. To be distinguished from **AUTHORING LANGUAGES** like PILOT, which are code systems uniquely suited for creating instruction and **AUTHORING SYSTEMS** for instruction, which involve little coding and can be used by non-programmers.

RANDOM-ACCESS: A method of storing information so it can be accessed in any order. Unlike film, for example, which must be played all the way through to get from beginning to end, random-access videodisc players can "jump" from information stored at the beginning to information stored at the end in a few seconds.

REFLECTIVE VIDEODISCS: Contains information imbedded as pits or holes in surfaces which reflect laser light onto a mirror and into a decoder. As opposed to **TRANSMISSIVE VIDEODISCS** in which the laser light may pass through the disc.

RGB: Red-Green-Blue. A type of color output to computer display consisting of red, green, and blue signals. As opposed to **COMPOSITE VIDEO** used in television sets. RGB usually offers higher picture resolution than composite.

RS-232C: Standard serial interface between a computer and its peripherals, including some videodisc players.

SEARCH TIME: Time required by a computer or disc player to locate a specific frame or other piece of information.

SECAM: Sequential Couleur a Memoire. Color television format in France and Russia. Not compatible with the U.S. standard (NTSC) or the European standard (PAL).

SIMULATION: The realistic portrayal or representation of a situation or device--with varying degrees of realism. In medicine, computers and videodiscs are used to create patient simulations that provide physicians and nurses with the opportunity to practice diagnosing and treating various medical conditions. Medical equipment may also be simulated for operator training.

SPEECH RECOGNITION: See Voice Recognition.

SPEECH SYNTHESIZER: A device that produces human speech sounds from recorded input, usually stored in a computer.

STAND-ALONE SYSTEMS: Equipment this functions on its own-- such as Level II videodisc players--without being connected to a larger network (such as an external computer).

STEP FRAME: A function of optical videodisc players to "step" from one frame to another, forward or backward.

STILL-FRAME AUDIO: A method of storing several seconds of voice-quality audio in a single frame of a disc. The voice must be digitally encoded, stored on the disc, then dumped into a decoder for playback. MEDCOM tried this approach on a disc contains several hundred slide/tape programs using the EECO still-frame audio system.

TOUCH SCREEN: A video and/or computer screen which acts as an input device to a computer with the touch of a finger. The user is often asked to touch an area of the screen in response to a question. Different technologies are used in touch screens, including infrared grids, small wires separated by air spaces, changes in electronic capacitance, acceleration detection, and others.

TRANSMISSIVE OPTICAL VIDEODISC: A transparent videodisc that allows the laser to pass through the disc to the decoder. First system was developed by Thompson/CSF and is no longer manufactured. Only transmissive system on market today is the McDonnell Douglas Electronics Company (MDEC) LaserFilm system.

TURNKEY SYSTEM: An off-the-shelf hardware system that is ready to run on delivery-just "turn the key".

VHD: Video High Density. A format for videodisc that uses a grooveless capacitance videodisc and a broad stylus to pick up data. Not an optical system. The format was developed by Matsushita/JVC and can both NTSC and PAL format discs.

VIDEODISC: A generic term used to describe any discs of various formats (optical and capacitance) used to store video for playback. May also store audio and data signals.

VIDEODISC FORMATS: One of four types of videodiscs: Reflective Optical Videodisc, Transmissive Optical Videodisc, Capacitive Electronic Disc (CED), and Video High Density (VHD).

VIDEOTEX: Low-resolution text and graphics stored in a computer and displayed using special decoders.

VOICE RECOGNITION: Technology which allows computer and videodisc programs to be controlled by voice commands. The TIME Project at the Library of Medicine is pioneering approach to videodisc-based patient simulations.



Appendix

ACCESS NETWORK
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CALGARY, ALB T2G 4S6 CANADA
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ACTRONICS INC
810 RIVER AVENUE
PITTSBURGH, PA 15212
800/851-3780

ALEXANDER DESIGN
200 SOUTH DESPLAINES STREET
CHICAGO, IL 60606
312/648-9880

ALIVE CENTER
1248 WEATHERVANE LANE
AKRON, OH 44313
216/869-9623

ALLEN COMMUNICATIONS
140 LAKESIDE PLAZA/5225 WILEY POST
SALT LAKE CITY, UT 84116
801/537-7800

AMERICAN ACAD ORTHOPAEDIC SURGEONS
222 SOUTH PROSPECT AVENUE
PARK RIDGE, IL 60068
312/823-7186

AMERICAN COLLEGE OF RADIOLOGY INST
1891 PRESTON WHITE DRIVE
RESTON, VA 22091
703/648-8989

AMERICAN MEDICAL ASSOCIATION
532 NORTH DEARBORN STREET
CHICAGO, IL 60610

AMERICAN SOC CLINICAL PATHOLOGISTS
2100 WEST HARRISON STREET
CHICAGO, IL 60612
312/738-4857

APPLE COMPUTER
MARKETING DEPARTMENT
10201 TORRE AVENUE MS 47A
CUPERTINO, CA 95014

APPLE COMPUTERS MS36N
MGR MEDICAL MARKET
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CUPERTINO, CA 95014

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621 LAKELAND EAST DRIVE
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601/939-2987

APPLIED VIDEO TECHNOLOGY
5118 WESTMINSTER PLACE
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120 30TH AVENUE NORTH
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STANFORD, CT 06903
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MINNEAPOLIS, MN 55437

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PHILADELPHIA, PA 19127
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11001 NORTH FULTON AVENUE
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CHICO, CA 95929
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7200 WISCONSIN AVENUE
BETHESDA, MD 20814
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60 OAK DRIVE
ORINDA, CA 94563
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CORNELL UNIVERSITY
PAYNE WHITING CLINIC/MEDIA CTR
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CORNELL UNIVERSITY MEDICAL COLLEGE
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P.O.S.S.U.M.
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MELBOURNE 3004, VICTORIA AUSTRALIA
03/520 5333

DANIEL J. EDELMAN INC
1775 BORADWAY
NEW YORK, NY 10019
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DARTMOUTH MEDICAL SCHOOL
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BUTLER BLDG 1 ROOM 108
HANOVER, NH 03756
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DIALOG INFORMATION SERVICES INC.
3460 HILLVIEW AVENUE
PALO ALTO, CA 94304
415/858-2700

DIGITAL DIAGNOSTICS INC.
601 UNIVERSITY AVENUE #255
SACRAMENTO, CA 95825
916/921-6629

DIGITAL EQUIPMENT CORP.
12 CROSBY DRIVE
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DRAGON EXPERT SYSTEMS
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EBSCO ELECTRONIC INFORMATION
P.O. BOX 13787
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